3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter is a summary of the affected environment for all resources potentially impacted by the Proposed Action. These resources are addressed based on management issues identified by the BLM, Great Divide RMP, public scoping, and by interdisciplinary desktop and field analyses of the BCII PA.

The Proposed Action is located in the ARPA, adjacent to the existing Brown Cow I POD, which has 12 existing wells and associated infrastructure (i.e. access roads, flowlines, produced water lines, water injection wells, and compressor station). The Proposed Action has the potential to affect the critical elements of the human environment, as listed in the BLM NEPA Handbook H-1790-1 (BLM 1988). Critical elements of the human environment, their status in the BCII PA, and their potential to be affected by the Proposed Action are identified in **Table 3-1**. Items listed as "None Present" are not addressed in this EA because they would not be affected by either the Proposed Action or the No-Action Alternative.

Table 3-1
Elements of the Human Environment, Brown Cow II Project,
Carbon County, Wyoming 2006

Element	Status in BCII PA	Addressed in EA
Geology/Minerals/Paleontology	Potentially Affected	Yes
Climate and Air Quality	Potentially Affected	Yes
Cultural Resources	Potentially Affected	Yes
Water Resources (surface and groundwater)	Potentially Affected	Yes
Wildlife/Fisheries (Federal threatened/endangered and sensitive species)	Potentially Affected	Yes
Range Resources/Land Use	Potentially Affected	Yes
Vegetation (including wetlands/riparian and noxious weeds)	Potentially Affected	Yes
Recreation	Potentially Affected	Yes
Visual Resources	Potentially Affected	Yes
Socioeconomics	Potentially Affected	Yes
Transportation	Potentially Affected	Yes
Native American Religious Concerns	Potentially Affected	Yes
Noise	Potentially Affected	Yes
Hazardous or Solid Waste	Potentially Affected	Yes
Soils	Potentially Affected	Yes
Health and Safety	Potentially Affected	Yes
Floodplains	None Present	No
Wild and Scenic Rivers	None Present	No

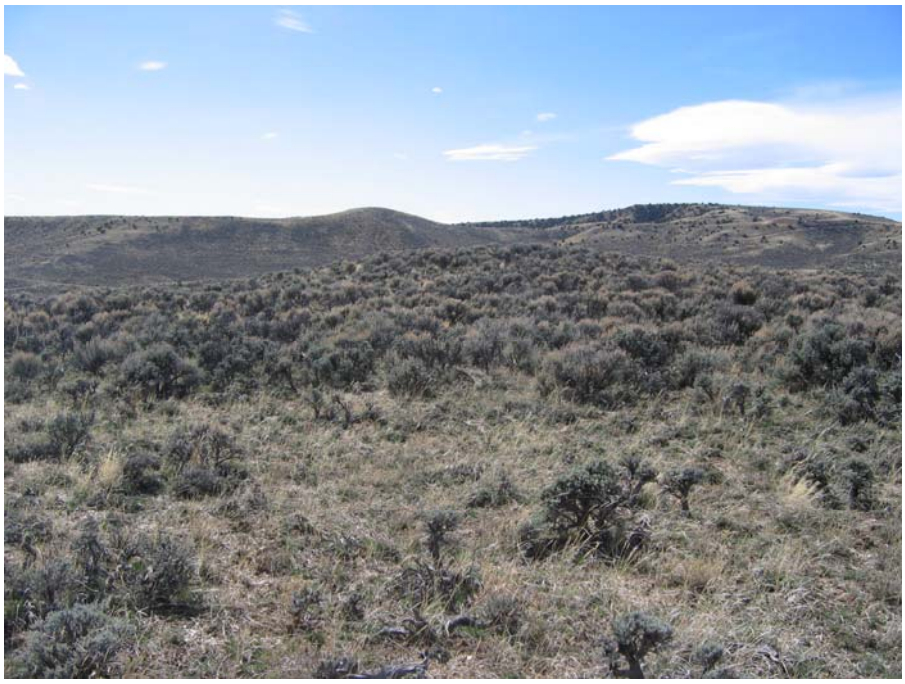
Element	Status in BCII PA	Addressed in EA
Wilderness	None Present	No
Environmental Justice	None Present	No
Areas of Critical and Environmental Concern	None Present	No
Prime and Unique Farmland	None Present	No

3.2 GEOLOGY, MINERALS, AND TOPOGRAPHY

3.2.1 Physiography, Topography, and Landforms

The BCII PA is located within the southeastern arm of the Washakie Basin, which is a sub-basin of the Greater Green River Basin in south-central Wyoming. Elevations in the BCII PA range from 6,600 feet to 7,200 feet. The majority of the terrain in the BCII PA is gently rolling hills, as seen in **Figure 3-1**; however, areas of steep terrain also occur within the BCII PA. This terrain generally supports the sagebrush species found throughout the BCII PA; however, Utah juniper (*Juniperus osteosperma*) can also be observed on the steeper hillsides. Washakie Basin is bordered on the east by the Sierra Madre Range, on the north by the Wamsutter Arch, and on the south by the Cherokee Ridge. The BCII PA is located west of the Mesaverde Group outcrop belt and east of the monocline forming most of the structural relief at the eastern margin of Washakie Basin.

Figure 3-1
Representative view of topography in the BCII PA



3.2.2 Geology

During the late Cretaceous and early Tertiary Periods, eroding sediments from the surrounding highlands and mountains filled the Greater Green River Basin as it began to develop approximately 70 million years ago. It was during the late Cretaceous Period that the basin was beneath a relatively shallow epicontinental sea that extended from the Atlantic Ocean to the Gulf of Mexico. Four major transgressive-regressive cycles of this epicontinental sea have been recorded from the middle Albian to the middle Maestrichian Periods. By the middle of the early Maestrichian Period the sea had retreated from south-central Wyoming.

The BCII PA is characterized at the surface by sedimentary deposits of Quaternary and Late Cretaceous age. Surface deposits are underlain by Phanerozoic-age sedimentary rocks of Cretaceous to Cambrian age, which are underlain by Precambrian metamorphic bedrock. The Precambrian metamorphic bedrock is more than two billion years in age.

BCII PA CBNG Producing Formations

Proposed BCII PA drilling intends to target and produce natural gas from coal, carbonaceous shale, and sandstone of the Mesaverde Group in the Almond, Pine Ridge, and Allen Ridge Formations. Interbedded coal, sandstone, and carbonaceous shale within the Haystack Mountain Formation may also be targeted in the BCII PA.

The Almond Formation contains three to nine individual coal beds interbedded with carbonaceous shale and sandstone. These coal beds have good lateral continuity. The average net coal thickness ranges from four feet to 10 feet and, locally, reaches thicknesses greater than 15 feet. Individual sandstone beds may vary in thickness and appear to be laterally continuous. Porosity within these sandstones ranges from 4% to 20%.

The Pine Ridge Formation contains six to 12 individual coal beds. The average net coal thickness ranges from 10 feet to 25 feet and, locally, reaches thicknesses greater than 40 feet. Pine Ridge sandstone beds vary in thickness from two feet to 10 feet and show poor lateral continuity. Porosity within these sandstones varies from 5% to 20%.

The Allen Ridge Formation contains one to 10 individual coal beds. The average net coal thickness ranges from one foot to four feet. These coals, unlike those in the Almond and Pine Ridge Formations, are more localized and are less laterally continuous. Allen Ridge sandstones within the coal, carbonaceous shale, and sandstone interval vary from two feet to 14 feet. Porosity within these sandstones ranges from 6% to 20%.

Burial Depth of Potential Target Formations

Overburden mapping on top of the Almond Formation (the top of the Mesaverde Group) shows the drilling depths to this formation in the BCII PA vary between 700 feet in the eastern portion of the area to about 1,500 feet in the southwestern portion of the area.

The primary producing coals in the Pine Ridge Formation occur between 250 feet to 300 feet below the top of the Almond Formation. Drilling depths in this formation range from 950 feet in the eastern portion of the area to approximately 1,750 feet in the southwestern portion of the area.

Stratigraphy of Mesaverde Formations in the BCII PA

The regional stratigraphy, as applied to the BCII PA, is established through correlation of wireline logs from the Browning Federal 4-12 well with the cross-sections of Roehler and Hansen (1989). **Table 3-2** shows the depths of important Mesaverde Group stratigraphic markers as they occur in the Browning Federal 4-12 well.

Table 3-2
Measured Depth of Important Stratigraphic Units in the Browning Federal 4-12 Well

Stratigraphic Unit	Measured Depth
Almond Formation	757 feet
Pine Ridge Formation	1,005 feet
Allen Ridge Formation	1,301 feet
Haystack Mountain Formation	2,745 feet
Hatfield Sandstone	2,992 feet
Cherokee Creek Sandstone	3,310 feet
Deep Creek Sandstone	3,493 feet
Base of the Mesaverde Group	3,767 feet

Source: Dewey 2005.

3.2.3 Mineral Resources

The Washakie Basin has produced substantial quantities of oil and natural gas for several decades. Oil and natural gas production is primarily from Cretaceous-age reservoirs, including the Mesaverde Group, Steele Shale, Niobrara Shale, Frontier Formation, Muddy Sandstone, and the Cloverly Formation. Mineral development in the BCII PA has been limited to natural gas and oil. At present, six groups of CBNG wells have been authorized within the ARPA.

3.2.4 Geologic Hazards

Geologic hazards primarily include earthquakes and mass movement of earth materials. Mass movements represent the greatest geologic hazard threat within the BCII PA. Mass movements include landslides, slumping, creep, and earth flowage and these hazards are typically associated with steep slopes and topography. Topography within the BCII PA is characterized as "hilly," punctuated by areas of 10% to 40% slopes. These steeper slopes represent an increased potential for mass movements.

Lewis and Lance Formations contain shale beds that are prone to mass movement when saturated. Lewis Shale is more susceptible to mass movement due to large areas of exposed and eroding shale. These formations are most susceptible to mass movement along the western side of their exposure where removal or erosion weakens them. Mass movements have been documented on steep slopes along Wild Horse Butte in the Lewis and Lance Formations (BLM 2003).

3.2.5 Paleontologic Resources

Fossils are known to occur in the Lance and Wasatch Formations, which occur primarily on the western and southern slopes and on top of Wild Horse Butte. These areas are minimal, spatially, and do not represent extensive outcrops of fossil-bearing formations. Additionally, Lewis Shale is known to contain invertebrate fossils and a "few" important vertebrate fossils. Lewis Shale is the most widely exposed geologic unit in the BCII PA (BLM 2003); however, no fossils have ever been recorded from the BCII PA.

3.3 CLIMATE AND AIR QUALITY

3.3.1 Climate

The BCII PA is located in an arid to semiarid climate. Weather conditions usually consist of dry, windy conditions with limited precipitation. Meteorological data for the BCII PA was collected at Baggs, Wyoming. Elevation and topography throughout the region create variations in temperature and precipitation patterns and, generally, the higher elevations experience colder temperatures and greater precipitation.

The average annual precipitation (from 1960 to 2006) at the BLM's Little Robber rain gauge, located approximately four miles west of the BCII PA, is 9.5 inches, with rainfall and snowfall contributing equally to the total. On average, 38.8 inches of snow falls per year, with December and January being the snowiest months.

The coldest average daily temperature during the winter occurs in January with a low of 5° F and a high of 33° F. In contrast, the warmest daily temperatures during the summer occur in July with a low of 48° F and a high of 86° F. The number of frost-free days varies with elevation, but normally occurs from May to September in the BCII PA.

3.3.2 Air Quality

The National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS) set the upper limits for concentrations of specific criteria air pollutants. These pollutants include CO, nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in size and less than 2.5 microns in size (PM_{10} and $PM_{2.5}$, respectively), sulfur dioxide (SO_2), and lead (Pb).

Under the Prevention of Significant Deterioration program (PSD), the permitting agency must determine if a new or modified emission source would have an adverse impact on air quality values, including visibility. Emissions sources in the BCII PA are limited, but are increasing with the development of natural gas exploration facilities. The atmospheric conditions in the BCII PA result in excellent dispersion of pollutants. Limited emission sources and weather conditions that result in good dispersion have allowed background levels of criteria pollutants to remain well below the NAAQS, WAAQS, and the Colorado Ambient Air Quality Standards (CAAQS). Colorado standards are considered in this analysis due to the potential dispersal of BCII emissions into their regulatory boundaries.

Table 3-3 shows the regional background concentrations of criteria air pollutants, NAAQS, WAAQS, CAAQS, and PSD Class I and II increments against the legal baseline provided by the

WDEQ and Colorado Department of Public Health and Environment. Background pollutant concentrations provide data to compare predicted impacts with applicable air quality standards.

Comparisons to the PSD Class I and II increments are intended to evaluate an "impact threshold" and do not represent a regulatory PSD Increment Consumption Analysis. The determination of PSD increment consumption is the responsibility of the WDEQ, with oversight from the U.S. Environmental Protection Agency (EPA).

Table 3-3
Background Concentrations and Ambient Air Quality Standards

Pollutant and Averaging Time	Background Concentration	National Ambient Air Quality Standard	Wyoming Ambient Air Quality Standards	Colorado Ambient Air Quality Standards	PSD Class I Increment	PSD Class II Increment
Carbon Monoxide (CO)[1]						
CO 1-hr	3,336	40,000	40,000	40,000	None	None
CO 8-hr	1,381	10,000	10,000	10,000	None	None
Nitrogen Dioxide (NO_2)[2]						
NO_2 Annual	3.4	100	100	100	2.5	25
Ozone (0_3) [3]						
O_3 1-hr	169	235	235	235	None	None
O_3 8-hr	147	157	157	157	None	None
Particulate Matter less than 10 microns (PM_{10})[4]						
PM_{10} 24-hr	47	150	150	150	8	30
PM_{10} Annual	16	50	50	50	4	17
Particulate Matter less than 2.5 microns ($PM_{2.5}$)[4]						
$PM_{2.5}$ 24-hr	15	65	65	65	None	None
$PM_{2.5}$ Annual	5	15	15	15	None	None
Sulfur Dioxide (SO_2)[5]						
SO_2 3-hr	29	1,300	1300	700	25	512
SO_2 24-hr	18	365	260	365	5	91
SO_2 Annual	5	80	60	80	2	20

Notes:

[1] *Background data collected by Amoco at Ryckman Creek for an 8-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).*

[2] *Background data collected at Green River Basin Visibility Study Site, Green River, Wyoming, during period January-December 2001 (ARS 2002).*

[3] *Background data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period June 10,1998 through December 31,2001.*

[4] *Background data collected by WDEQ-AQD at Emerson Building, Cheyenne, Wyoming, Year 2002. These data have been determined by WDEQ-AQD to be the most representative co-located PM_{10} and $PM_{2.5}$ data available.*

[5] *CDPHE-APCD, 1996 – Data collected at the Craig Power Plant site and Colorado Oil Shale areas from 1980-1984.*

Air Quality Related Values

In addition to ambient air quality standards and PSD increments, Air Quality Related Values (AQRVs), which include the potential air pollution effects on visibility and the acidification of surface water bodies, is a concern for sensitive PSD Class I and II areas. Strict regulatory stipulations are placed on the amount of air pollution allowed from major emitting facilities in PSD Class I areas.

Emission sources can contribute to two types of visual impairment: regional haze and plume impairment. Regional haze occurs when pollutants from multiple emission sources become mixed in the atmosphere, creating visual impairment of the landscape. Plume impairment is when a distinct layer of the atmosphere becomes visible due to the emission plume contrast to background landscape features.

Visibility is often defined in terms of atmospheric light extinction or visual range, which is the farthest distance a person can see a landscape feature. Impairment of visibility is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change and a change in visibility of 1.0 dv represents a "just noticeable change" by the average person under most circumstances. Larger dv values translate into greater visibility impairment. The U.S. Forest Service (USFS) has identified specific "Level of Acceptable Change" (LAC) values, which they use to evaluate potential air quality impacts within wilderness areas.

Continuous visibility-related background data collected as part of the Interagency Monitoring of PROtected Visual Environments (IMPROVE) program are available for four sensitive PSD Class I receptors within the study area: Bridger, Brooklyn Lake, Mt. Zirkel Wilderness, and Rocky Mountain National Park. **Table 3-4** provides 2001 baseline visibility conditions monitored at these four sites (BLM 2005). As shown in **Table 3-4**, seasonal visibility in the region is very good.

Table 3-4
Standard Visual Range Data

Site	Standard Visual Range (km)	
	Average Condition	20th Percentile Cleanest Days
Bridger Wilderness Area	181	272
Brooklyn Lake	184	283
Mount Zirkel Wilderness Area	175	249
Rocky Mountain National Park	154	275

Acid Deposition

Acidification of surface water bodies is a concern for high altitude lakes located within USFS wilderness areas. Atmospheric acid deposition is monitored as part of the National Acid Deposition Program/National Trends Network near Pinedale, Wyoming. Although the monitored deposition values are well below those levels needed to damage vegetation, lower levels of deposition may exceed the acid neutralizing capacity (ANC) of sensitive high mountain lakes.

To determine potential acid deposition impacts, the USFS utilizes a LAC of no greater than one microequivalent/liter (µeq/L) change in ANC for sensitive water bodies with existing ANC levels less than 25 µeq/L. A limit of 10% change in ANC reduction was adopted for lakes with an existing ANC greater than 25 µeq/L. **Table 3-5** shows baseline ANC levels for selected sensitive mountain lakes in the region.

Table 3-5
Background ANC for Monitored Wilderness Lakes

Wilderness Area	Lake	10th Percentile Lowest ANC Value
Bridger	Black Joe	67.0
Bridger	Deep	59.9
Bridger	Hobbs	69.9
Bridger	Lazy Boy	18.8
Bridger	Upper Frozen	5.0
Fitzpatrick	Ross Lake	53.5
Glacier Lakes Ecosystem Experiments Site	West Glacier Lake	35.2
Mount Zirkel	Lake Elbert	51.9
Mount Zirkel	Seven Lakes	36.2
Mount Zirkel	Summit Lake	47.3
Popo Agie	Lower Saddlebag	55.5
Rawah	Island Lake	68.7
Rawah	Kelly Lake	181.1
Rawah	Rawah #4 Lake	41.2

3.4 SOILS

There is currently no Natural Resource Conservation Service (NRCS) soil survey available for Carbon County, Wyoming. However, in 1981 Texas Resource Consultants (TRC) and Wells *et al*. were contracted to produce soils data at a third-order level of detail for the BLM and in coordination with the NRCS, known at the time as the Soil Conservation Service (SCS). These data were used to describe the soil series, associations, and complexes that occur within the BCII PA. The interpretation rating for each map unit was based upon the standards and procedures of

the SCS National Soils Handbook, the SCS Guide for Interpreting Engineering Uses of Soils, Portland Cement Association Soils Primer, and Wischmeier and Smith (1978).

According to the TRC and Wells *et al*. surveys, there are five soil associations mapped in the BCII PA: Pinelli-Forelle complex, Cushool-Rock River Association, Pinelli-Boettcher clay loam, Blazon-Shinbara-Rentsac complex, and Forelle-Diamondville loams. Refer to **Figure 3-3** for a map of soil association locations within the BCII PA.

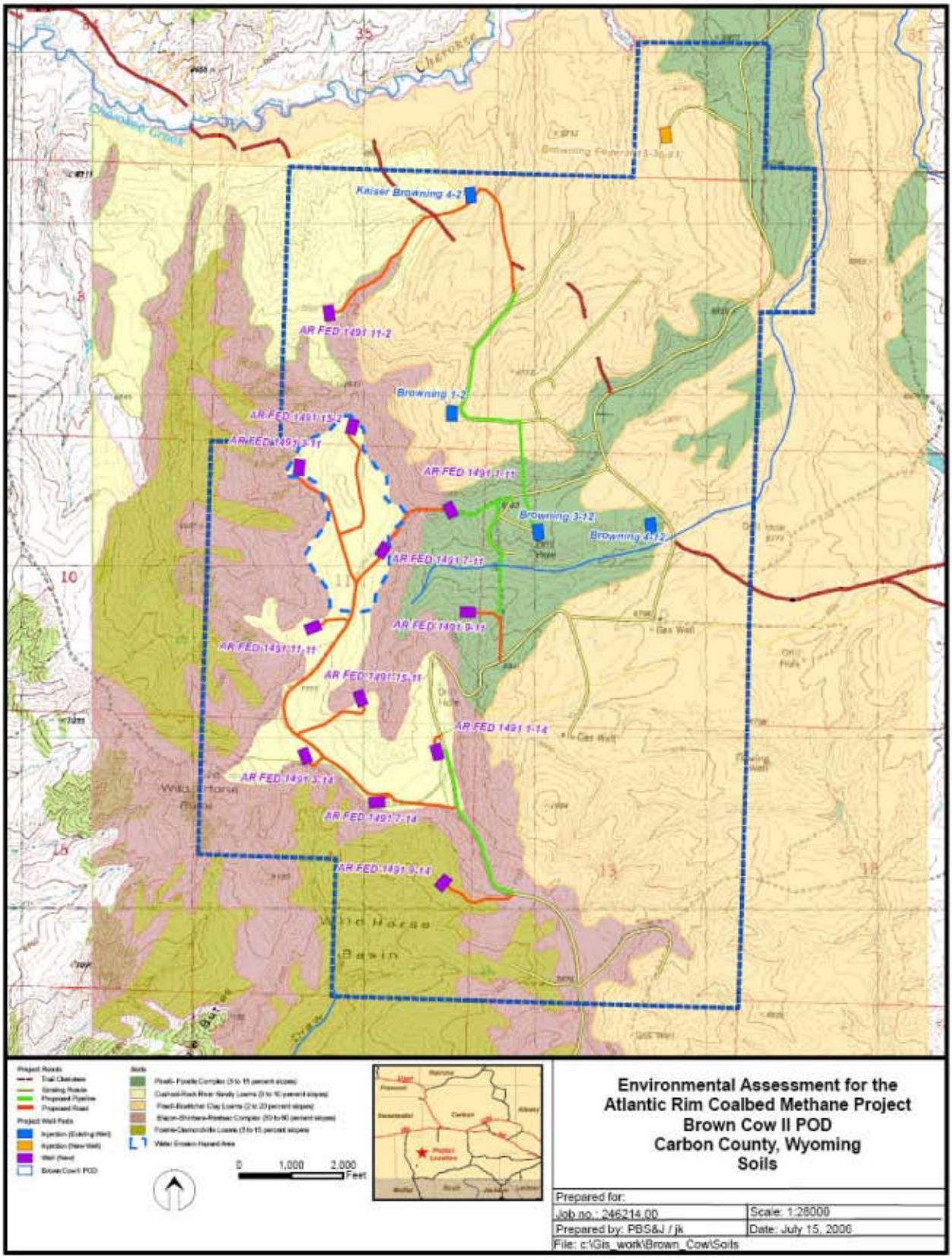
Two PBS&J biologists conducted a field visit with three BLM representatives on April 12 and 13, 2006. The BLM representatives highlighted areas of concern on the BCI PA such as erosion on existing roads, insufficient drainage capacity at pad sites, and poor reestablishment of vegetation. The biologists then tested soils at the proposed well pads and associated access roads. Soil pits were dug and the soils assessed for their depth, texture, erosion hazard, and bearing strength. One area of concern was identified within the BCII PA; the soil pit dug at proposed well pad AR Federal 1491 7-11 revealed weathered shale soils. The proposed access road both north and south of the proposed well pad had similar soils and exhibited signs of advanced water erosion. The area, as seen on **Figure 3-2**, was labeled a water erosion hazard zone.

Soils within the BCII PA are generally uniform with slight variations in color and texture. A top layer, ranging from two inches to four inches in depth, was generally observed to be composed of light brown silt loam. The second layer was generally brown silt clay and soils were observed to be shallow to moderately deep. With the exception of the designated water erosion hazard zone, soils at the BCII PA have moderate wind erosion and water erosion potential; soils in the hazard zone have severe water erosion potential.

Figure 3-2
Soil Erosion Hazard

Severely eroded drainage ditch on north side of road located north of AR Federal 1491 7-11.

Figure 3-3
Soils



3.5 WATER RESOURCES

3.5.1 Groundwater

Groundwater resources include deep and shallow confined and unconfined aquifers. Site-specific data on groundwater for the BCII PA are limited. The regional flow of the groundwater in the project area is to the west. The groundwater in the vicinity of the BCII PA is located in different geological units. The Quaternary aquifers in the vicinity of the BCII PA are sandy and drain downward towards permeable formations (Collentine *et al.* 1981). The Tertiary aquifers found in the vicinity of the BCII PA flow in a west-southwest direction from the higher elevations of the Sierra Madre Uplift to the center of the Washakie Basin and the major streams in the area (Collentine *et al.* 1981). Cretaceous aquifers are composed of interbedded sandstone, shale, and coal (Collentine *et al.* 1981). Flows in the Cretaceous period formations are to the west and they are recharged by infiltration of precipitation through the Tertiary sediments. The producing coal seams in the Mesaverde Group, of the Cretaceous period formations, are classified as confined to semi-confined because they are bounded by confining layers that consist of impervious to semi-pervious layers of shale and siltstone. There is a potential for hydraulic connection between the coal seams and any aquifer stratigraphically above or below the coal seams. Separated by the impermeable Morrison Formation are the Jurassic-aged Sundance-Nugget aquifers. The Sundance-Nugget Formation is comprised of permeable sandstone, with traces of shale, siltstone, and limestone. The flow direction in the aquifers is not well defined (Collentine *et al.* 1981). The deepest aquifers are found in the Paleozoic era formations. The Triassic-aged aquifer is composed of fine to medium-grained sandstone, confined by the Chugwater Formation. The Pennsylvanian-aged aquifer is composed of dolomite and limestone and is confined by fine-grained Amsden sediments above and Cambrian rocks underneath (Collentine *et al.* 1981). These aquifers have produced flow rates up to 400 gallons per minute.

The depth of the proposed injection wells, which would be completed for the Haystack Mountain Formation, is expected to be between 3,000 feet and 5,000 feet. The rocks that compose the Mesaverde Group are conglomerates, consisting of sandstone, siltstone, mudstone, claystone, carbonaceous shale, limestone, and coal. Because these rocks were deposited as sea level changed during the Late Cretaceous Period, lithology varies vertically and laterally, and intertounging is common among the various formations and strata that make up these aquifers. Recharge is mainly from infiltration of snowmelt and rainfall.

3.5.1.1 Quality

Groundwater quality is related to aquifer depth, flow between aquifers, and rock type. Groundwater quality is variable in the BCII PA. TDS, an indicator of salinity, is generally less than 2,000 mg/L (slightly saline to saline) in the BCII PA producing formations, with local concentrations less than 500 mg/L (considered fresh and meeting EPA National Secondary Drinking Water Regulations).

The proposed BCII wells occur in the Mesaverde Group aquifers. **Table 3-6** lists the major cation and anion composition of groundwater from the Mesaverde Group in the BCII PA. Sodium and bicarbonate dominate as the major ionic species. Collentine *et al*. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction, resulting in generation of bicarbonate; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde Group or adjacent aquifers.

Table 3-6
Major Ion Composition of Mesaverde Groundwater

Cation	Concentration (mg/L)	Anion	Concentration (mg/L)
Sodium	513	Bicarbonate [a]	1,284
Calcium	7	Carbonate [b]	9
Magnesium	3	Chloride	56
Potassium [b]	5	Sulfate	11

Notes:

mg/L= milligrams per liter.

[a] *Bicarbonate was not measured; value shown was calculated from ion balance.*

[b] *Concentrations of potassium and carbonate were not measured in well samples; values represent a composite of USGS data for Mesaverde wells in the vicinity of the project (USGS 1980).*

In addition to inorganic analysis, isotopic analysis has been performed on groundwater collected from numerous wells constructed within the interim drilling PODs. Groundwater samples from eight CBNG wells were analyzed for tritium, a radioactive isotope of hydrogen, deuterium, and ^{18}O stable isotopes of hydrogen and oxygen.

Table 3-7 presents a comparison of groundwater quality from the Mesaverde Group, including WDEQ standards for groundwater suitability. The results from three gas wells analyzed indicate water that is generally suitable for livestock use, but is unsuitable for domestic supply or irrigation without treatment or dilution. Parameters measured at concentrations that exceed drinking water standards include iron, manganese, and TDS. Calculated values for sodium adsorption ratio (SAR) (47.3) and residual sodium carbonate (41 meq/L) exceed the agriculture suitability limits of eight for SAR and 1.25 for residual sodium carbonate. Unless the water supply were mixed with an existing water source of lower sodium, bicarbonate, and lower total salinity, irrigation with this water would reduce infiltration in the affected soil and potentially decrease crop production.

Table 3-7
Groundwater Quality for Mesaverde Wells in the BCII PA

Parameter	Concentration[a]	Unit	Groundwater Suitability Standards[b]		
			Domestic	Agriculture	Livestock
Aluminum	0.045	mg/L	---	5	5
Ammonia	0.9	mg/L	0.5	---	---
Arsenic	0.0006	mg/L	0.05	0.1	0.2
Barium	0.36	mg/L	1	---	---
Beryllium	<0.002	mg/L	---	0.1	---
Boron	0.25	mg/L	0.75	0.75	5
Cadmium	<0.0002	mg/L	0.01	0.01	0.05
Chloride	56	mg/L	250	100	2,000
Chromium	0.002	mg/L	0.05	0.1	0.05
Cobalt	NM	mg/L	---	0.05	1
Copper	0.03	mg/L	1	0.2	0.5
Cyanide	<5	mg/L	0.2	---	---
Fluoride	1.0	mg/L	1.4 - 2.4	---	---
Hydrogen Sulfide	NM	mg/L	0.05	---	---
Iron	3.06	mg/L	0.3	5	---
Lead	0.004	mg/L	0.05	5	0.1
Lithium	NM	mg/L	---	2.5	---
Manganese	0.102	mg/L	0.05	0.2	---
Mercury	<0.0004	mg/L	0.002	---	0.00005
Nickel	0.041	mg/L	---	0.2	---
Nitrate	<0.03	mg/L	10	---	---
Nitrite	<0.03	mg/L	1	---	10
Oil and Grease [c]	<1	mg/L	Virtually Free	10	10
Phenol	65	mg/L	0.001	---	---
Selenium	<0.005	mg/L	0.01	0.02	0.05
Silver	<0.003	mg/L	0.05	---	---
Sulfate	11	mg/L	250	200	3000
TDS	1,322	mg/L	500	2000	5000
Uranium	NM	mg/L	5	5	5
Vanadium	NM	mg/L	---	0.1	0.1
Zinc	0.3	mg/L	5	2	25
pH	8.2	s.u.	6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
SAR	47.3	<none>	---	8	---

Parameter	Concentration[a]	Unit	Groundwater Suitability Standards[b]		
			Domestic	Agriculture	Livestock
RSC [d]	41	meq/L	---	1.25	--
Radium 226 + Radium 228	0.9	pCi/L	5	5	5
Strontium 90	NM	pCi/L	8	8	8
Gross alpha	NM	pCi/L	15	15	15

Notes:

meq/L = Milliequivalents per liter
mg/L = Milligrams per liter
NM = Not measured
pCi/L = Picocuries per liter
s.u. = Standard units
TDS = Total dissolved solids

[a] *Concentrations of boron, ammonia, fluoride, and nitrate/nitrite in samples from 11 Mesaverde groundwater wells (USGS 1980); remaining concentrations from three Mesaverde gas wells in BCII PA.*

[b] *From WDEQ Water Quality Rules and Regulations, Chapter VIII.*

[c] *Reported as total petroleum hydrocarbons.*

[d] *Residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated concentration of bicarbonate.*

3.5.2 Surface Water

The BCII PA is located within the Little Snake River drainage basin (United States Geological Survey [USGS] Hydrologic Unit Code 140500). An unnamed ephemeral tributary to Smiley Draw and Wild Horse Draw are located within the BCII PA. Smiley Draw and several other surface waters near the BCII PA flow into Deep Creek. Deep Creek is one of four primary ephemeral tributaries to Muddy Creek, which is an intermittent to perennial stream that carries water to its confluence with the Little Snake River (located near Baggs, Wyoming). The Little Snake River drains the west slopes of the Sierra Madre in south-central Wyoming and it joins the Yampa River in northwest Colorado. The Yampa River flows southwest to its confluence with the Green River in Utah.

3.5.2.1 Quantity

Flow statistics have been compiled from USGS gaging stations #0925900 and #09258980, which are located on Muddy Creek. There are no stream gaging stations in the BCII PA. Peak flows for streams within the BCII PA typically occur in late May and early June in response to snow melt. Following peak flow events, creeks and drainages only flow in direct response to rainfall events. This information is summarized in **Table 3-8**.

Table 3-8
Streamflow at Selected USGS Gaging Stations

Station Name	Station Number	Drainage Area (mi^2)	Period Of Record	Mean Flow (cfs)	Average Annual Runoff (ac-ft/yr)	Median Flow (cfs)	Min Flow (cfs)	Max Flow (cfs) and Date
Muddy Creek Near Baggs	09259000	1,257	10/1/87-9/30/91	14.8	10,690	2.8	0.03	632 3/23/88
Muddy Creek below Young Draw near Baggs	09258980	1,150	4/17/04-present	19.1	13,828	3.7	0.13	236 1/12/05

Source: USGS 2006
Notes:
mi^2 = square mile
cfs= cubic feet per second
ac-ft/yr= acre-feet per year

3.5.2.2 Quality

No water quality data is available for the BCII PA; however, some data is available for Muddy Creek and Smiley Draw (which are characteristic streams found in the Little Snake River drainage basin). Water quality data collected at the USGS gaging stations on Muddy Creek and Smiley Draw are shown in **Table 3-9**. In general, because many of these creeks only flow in response to precipitation events, sediment loads can be high. In addition, many areas with saline soils generally have higher TDS values.

Table 3-9
Surface Water Quality – Muddy Creek [a]

Station Name	Smiley Draw	Muddy Creek	Muddy Creek	Muddy Creek
Station Number	1409018F	09258900	09259000	09258980
Period of Records	1988-1989	1976-1978	1957-1991	May 2005-present
Number of Samples [b]	2	3	41	NM
pH, standard units	8.24	8.6	8.2	NM
Total Dissolved Solids (TDS) [c]	598	913	346	NM
Total Suspended Solids (mean)	61	6,198	3,191	NM
Turbidity (JTUs) [d]	NM	1,260	NM	NM
Hardness as $CaCO_3$	0	315	270	NM

Station Name	Smiley Draw	Muddy Creek	Muddy Creek	Muddy Creek
Dissolved Oxygen	NM	11	10	NM
Sodium	1416	200	286	NM
Calcium	0.9	54	42	NM
Magnesium	0.5	44	40	NM
Potassium	2.4	7	9	NM
Bicarbonate	3,698	373	308	NM
Sulfate	1.05	380	320	NM
Chloride	5.9	65	32	NM
Conductance (mean) [b]		1,350	966	1,300

Source: USGS 2006

Notes:

[a] *Values all representative of means*

[b] *Total number of grab samples analyzed; not every parameter was analyzed in every sample.*

[c] *All units are milligrams per liter (mg/L), except as noted*

[d] *Jackson Turbidity Units.*

NM = Not measured

3.5.2.3 Waters of the United States

Most of the surface water features in the BCII PA qualify as waters of the U.S. The term "waters of the U.S." generally includes all surface waters and their tributaries, impoundments, and wetlands. Waters of the U.S. other than wetlands, such as streams and intermittent drainages, are typically identified as having a defined bed and bank and an "ordinary high water mark" (OHWM). Activities that involve discharges of dredge or fill material into such areas is subject to regulation by the USACE pursuant to Section 404 of the Clean Water Act (CWA).

3.6 VEGETATION, WETLANDS, AND INVASIVE WEEDS

3.6.1 Vegetation and Cover Types

Vegetation in the BCII PA is dominated by alkali sagebrush *(Artemesia longiloba)* and mountain big sagebrush (*Artemisia tridentata ssp. vaseyana)*; however, areas of higher elevation and steeper slopes contain juniper woodlands. Wyoming big sagebrush, juniper woodland, mountain big sagebrush mixed with mountain shrub, and basin big sagebrush represent secondary cover types mapped within the BCII PA (see **Table 3-10** for acreages). Vegetation cover types for the BCII PA were mapped for the Atlantic Rim EIS (see **Figure 3-4**). This data has been used to delineate vegetation cover type boundaries for the BCII PA. Information for plant species of concern was obtained from the Wyoming Natural Diversity Database (WYNDD) (2005).

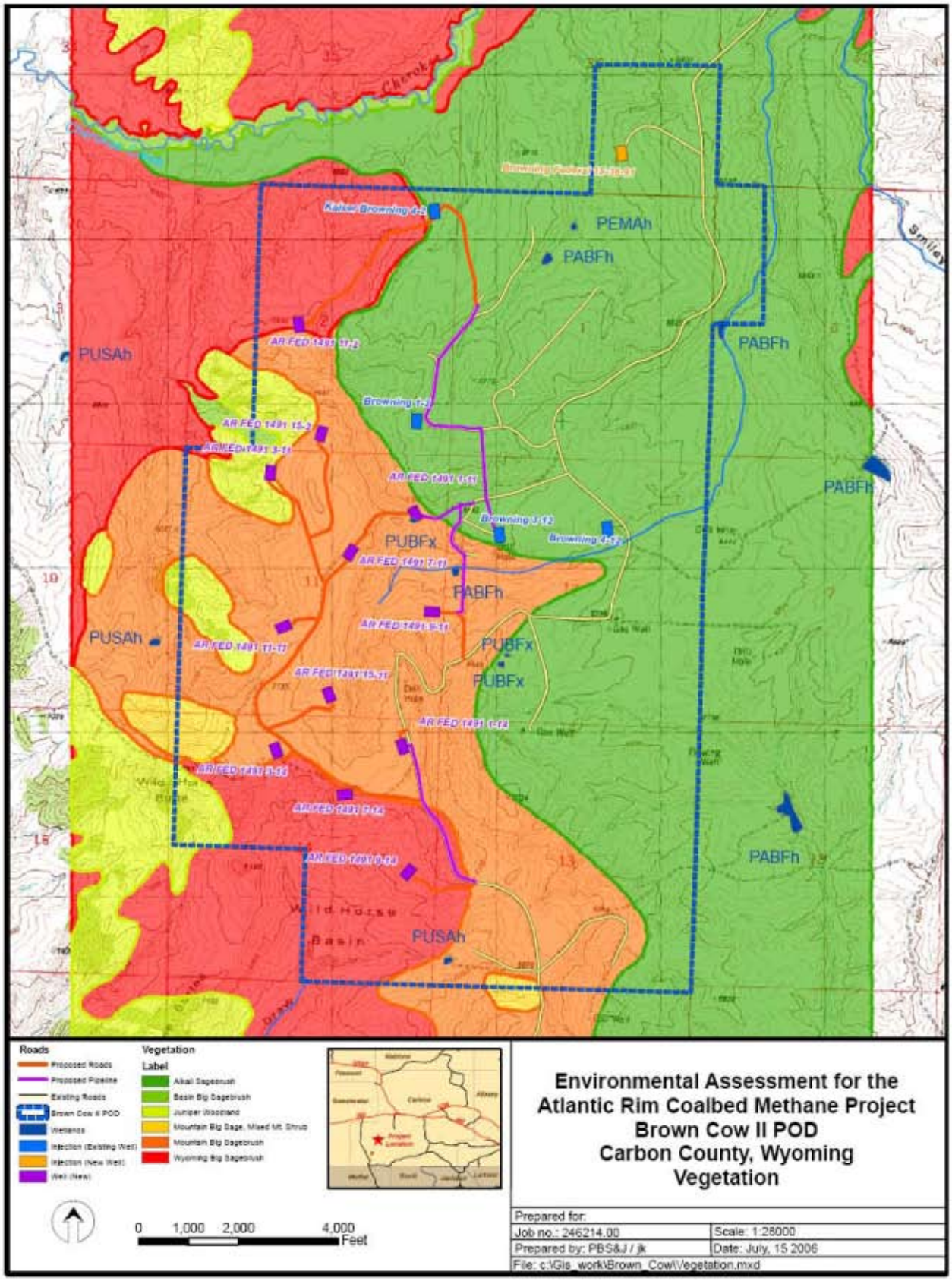
Table 3-10
Vegetation Cover Types within the BCII PA

Vegetation Cover Type	Primary	
	Acres	Percent
Alkali sagebrush	1,842.6	49.9
Mountain big sagebrush	1,158.5	31.4
Wyoming big sagebrush	509.8	13.8
Juniper woodland	143.9	3.9
Mountain big sagebrush mixed with mountain shrub	32.4	0.9
Basin big sagebrush	4.8	0.1
TOTAL	3,692	100

The northeastern portion of the BCII PA is dominated by alkali sagebrush. This sagebrush is typically found below 7,500 feet in clay soils with high cation exchange capacity. Common grass and forb species associated with alkali sagebrush include: bottlebrush squirreltail (*Elymus elymoides*), mutton bluegrass (*Poa fendleriana*), little bluegrass (*Poa secunda*), western wheatgrass *(Pascopyrum smithii),* Indian ricegrass *(Achnatherum hymenoides),* false dandelion *(Agoseris glauca),* Hood's phlox *(Phlox hoodii),* hollyleaf clover (*Trifolium gymnocarpon*), penstemon (*Penstemon* sp.), and biscuitroot *(Lomatium caruifolium).*

In addition to alkali sagebrush, the mountain big sagebrush cover type is also dominant within the BCII PA and is typically found at elevations around 7,000 feet and higher. This multi-branched shrub varies in height and density based on soils, moisture, and topography. Common grass species associated with mountain big sagebrush include: thickspike wheatgrass (*Elymus macrourus*), bluebunch wheatgrass (*Pseudoregneria spicata*), little bluegrass, needle-and-thread (*Hesperostipa comata*), bottlebrush squirreltail, prairie junegrass (*Koeleria cristata*), mutton bluegrass, green needlegrass (*Nassella viridula*), oniongrass (*Melica bulbosa*), Idaho fescue (*Festuca idahoensis*), and spike fescue (*Leucopa kingii*). The shrub understory of mountain big sagebrush generally includes rabbitbrushes (*Chrysothamnus spp*.) and snowberry (*Symphoricarpos oreophilus*), with lesser amounts of bitterbrush (*Purshia tridentata*) and serviceberry (*Amelanchier alnifolia*).

Figure 3-4
Vegetation



3.6.2 Federal Threatened and Endangered Plant Species

Three Federally-listed plant species, the blowout penstemon (*Penstemon haydenii*), Ute ladies'-tresses (*Spiranthes diluvialis)*, and Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*) are listed as potentially occurring on lands administered by the RFO (USDI-FWS 2003). However, only the blowout penstemon and Ute ladies'-tresses could potentially occur in the Carbon County portion of lands administered by the RFO.

Blowout penstemon

Blowout penstemon is a member of the Scrophulariaceae (Figwort) family (Fertig 2001) and is one of the rarest plant species native to the Great Plains (Nebraska Game and Parks Commission [NGPC] 2002). The species is found in the open, sandy habitats of wind-excavated depressions (blowouts) in dune tops. In Wyoming, the species has also been documented on very steep, unstable sand dunes. Within these limited habitats, this short-lived perennial herb frequently occurs in large, multi-stemmed clumps. In June and July, when it is in bloom in Wyoming, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts.

Blowout penstemon, a USFWS endangered species, is known to occur in certain habitats south of the Ferris Mountains in the northern part of Carbon County. Suitable habitat for blowout penstemon is not present in the BCII PA; therefore, this species is not expected to occur within the BCII PA.

Ute ladies'-tresses

The Ute ladies'-tresses *(Spiranthes diluvialis)*, a USFWS threatened species, is a perennial, terrestrial orchid, endemic to moist soils near wetland meadows, springs, lakes, and perennial streams. It occurs generally in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows at elevations from 4,200 feet to 7,000 feet. The orchid colonizes early successional riparian habitats such as point bars, sand bars, and low lying gravelly, sandy, or cobbly edges, persisting in those areas where the hydrology provides continual dampness in the root zone throughout the growing season. This species has been located in Converse, Goshen, Laramie, and Niobrara Counties in Wyoming (Fertig 2000). Ute ladies'-tresses typically blooms from late July through August; however, it has been known to bloom in early July and as late as early October (USDI-FWS 2003). Suitable habitat for the Ute ladies'-tresses does not occur within the BCII PA; therefore, this species is not expected to occur within the BCII PA.

3.6.3 Species of Concern

Seven plant species of special concern may potentially occur on or near the BCII PA (USDI-BLM 2002, WYNDD 2005). Plants of special concern that may occur in the RFO management area and information on sensitivity status, probability of occurrence in the BCII PA, and descriptions of habitat types in which these special concern plants are found are listed in **Table 3-11**. Of these, Gibben's beardstongue has the highest conservation priority (WYNDD 2005) and particular attention should be given to avoid impact to this species. None of the species listed have known occurrences within the BCII PA (WYNDD 2005).

Table 3-11
Sensitive Plant Species with Potential to Occur On or Near the BCII PA

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Cedar rim thistle	*Cirsium ownbeyi*	G2Q/S2	Barren, chalky hills, gravelly slopes and fine textured, sandy-shaley draws from 6,700 feet to 7,200 feet.	Unlikely
Gibben's beardtongue	*Penstemon gibbensii*	G1/S1	Barren south-facing slopes on loose sandy-clay derived from Brown's Park formation; may occur in grass-dominated sites with scattered shrubs; semi-barren fringed sagebrush/thickspike wheatgrass communities with 15-20% vegetation cover, or ashy slopes amid *Cercocarpus montanus*; may also occur on outcrops of Green River Formation on steep yellowish sandstone-shale slopes below caprock edges.	Possible
Laramie Columbine	*Aquilegia laramiensis*	G2/S2, FRS2	Crevices of granite boulders and cliffs 6,400 feet to 8,000 feet.	Unlikely
Laramie false sagebrush	*Sphaeromeria simplex*	G2/S2	Cushion plant communities on rocky limestone ridges and gentle slopes 7,500 feet to 8,600 feet.	Unlikely
Nelson's milkvetch	*Astragalus nelsonianus*	G2/S2	Alkaline clay flats, shale bluffs, pebbly slopes and volcanic cinders in sparsely vegetated sagebrush, juniper and barren clay slopes 6,500 feet to 8,200 feet.	Possible
Persistent sepal yellowcress	*Rorippa calycina*	G3/S2S3	Riverbanks and shorelines, usually on sandy soils near high-water line.	Unlikely
Weber's scarlet gilia	*Ipomopsis aggregate ssp. Weberi*	G5T1T2Q/ S1, FSR2	Openings in coniferous forests and scrub oak woodlands 8,500 feet to 9,600 feet.	Unlikely
Wolf's orache	*Atriplex wolfii*	G3/G4/S1	Alkaline or clay soils; elevated mounds near aquatic sites; associated with greasewood.	Possible

Sources: USDI-BLM (2002), WYNDD (2005).
Notes:

[1] *Definition of status:*
G Global rank: Rank refers to the range-wide status of a species.
T Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.
S State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.
1 Critically imperiled because of extreme rarity (often known from five or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.
2 Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.

3 Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).
4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5 Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

[2] Occurrence potential based upon presence of suitable habitat, known distribution, WYNDD records, WGFD records, and field surveys.

3.6.4 Wetlands

The location and classification of potential wetlands within the BCII PA were determined from USFWS National Wetlands Inventory (NWI) data. Four types of wetland features (totaling 4.2 acres) are located within the BCII PA. The Cowardin System (Cowardin *et al*. 1979) classifies the wetland types as follows (see **Table 3-12**): PABFh – Palustrine, aquatic bed, semipermanently flooded, diked/impounded; PEMAh – Palustrine, emergent, temporarily flooded, diked/impounded; PUBFx – Palustrine, unconsolidated bottom, semipermanently flooded, excavated; and PUSAh – Palustrine, unconsolidated shore, temporarily flooded, diked/impounded. The BLM does not have any Proper Functioning Class (PFC) data for the BCII PA. The closest PFC data is to the north and northeast of the BCII PA in the Cherokee Creek and Smiley Draw watersheds and no apparent concerns were identified for either of these areas.

Table 3-12
USFWS National Wetlands Inventory
Classification of Wetlands Present Within the BCII PA

Wetland Type[a]	Polygon Features		
	Count	Wetland Type	Acres
PABFh	3	Freshwater Pond	2.2
PEMAh	1	Freshwater Emergent Wetland	0.3
PUBFx	3	Freshwater Pond	0.7
PUSAh	1	Freshwater Pond	1.0
Total	8		4.2

Source: USFWS NWI data.
Note:
[a] See Cowardin et al. (1979) for classification description. Available at the NWI website: http://www.nwi.fws.gov/Pubs_Reports/public.htm

3.6.5 Noxious and Invasive Weeds

Weed invasion and establishment is present in the BCII PA. A field survey on April 12th and 13th, 2006 was conducted to investigate the presence of noxious or invasive species along existing and proposed roads and well pad sites within the BCII PA. The following invasive species were documented in small scattered patches along existing roads and previously disturbed pad sites within the BCII PA: black henbane *(Hyoscyamus niger*), cheat grass (*Bromus tectorum L*.), curlycup gumweed (*Grindelia squarrosa*), annual goosefoot (*Chenopodium spp*.),

and bull thistle *(Cirsium vulgare*). There is one previously document occurrence of Russian knapweed (*Salsola iberica*) within as well as one mapped occurrence north of the BCIIPA.

No State-listed noxious weed species (see **Table 3-13**) were documented within the BCII PA during the field survey; however, this area is vulnerable to invasion of noxious and invasive weed species such as Canada thistle (*Cirsium arvense*), spotted knapweed (*Centaurea maculosa Lam.*), musk thistle *(Carduus nutans),* whitetop (*Cardaria draba*), as well as invasive species such as, halogeton (*Halogeton glomeratus*), and several annual mustards, which have been documented within the ARPA (USDI-BLM 2005). These invasive and noxious species are normally restricted to disturbed areas.

Any newly disturbed surface (e.g. well pads, pipeline and road ROWs) within the BCII PA would be susceptible to invasive/noxious weed infestations. In addition, seeds can be transported along highways and roads by construction equipment and vehicles. **Table 3-13** shows the current designated noxious weed list for Wyoming.

Table 3-13
Designated Noxious Weeds in Wyoming

Scientific Name	Common Name
Agropyron repens	Quackgrass
Ambrosia tomentosa	Skeletonleaf bursage
Arctium minus	Common burdock
Cardaria draba, C. pubescens	Hoary cress, whitetop
Carduus acanthoides	Plumeless thistle
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Salsola iberica	Russian knapweed
Chrysanthemum leucanthemum	Ox-eye daisy
Cirsium arvense	Canada thistle
Convolvulus arvensis	Field bindweed
Cynoglossum officinale	Houndstongue
Euphorbia esula	Leafy spurge
Isatis tinctoria	Dyers woad
Lepidium latifolium	Perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	Yellow toadflax
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sonchus arvensis	Perennial sowthistle
Tamarisk spp.	Salt cedar
Hypericum perforatum	Common St. Johnswort
Tanacetum vulgara	Common tansy

Source: Designated Noxious Weeds, Wyoming Stat. § 11-5-102 (a)(xi) and Prohibited Noxious Weeds, Wyoming Stat. § 11-12-104.

In addition to the 24 species listed in **Table 3-13**, halogeton, plains prickly pear, larkspur, and lupine are declared noxious by Carbon County (Justesen 2004).

3.7 RANGE RESOURCES/LAND USE

The BCII PA is comprised entirely of Federally-owned lands and is located completely within the Cherokee Grazing Allotment (CGA). The CGA encompasses approximately 73,966 acres, the majority of which is public land. Cattle (cow/calf) and sheep are pastured in the CGA, which supports 6,412 cattle animal unit months (AUMs) and 1,588 sheep AUMs, for a total of 8,000 AUMs. The average stocking rate is approximately eight acres per AUM (Warren 2005).

The CGA is divided into six main pastures. The BCII PA falls within two of these pastures: the Deep Creek pasture to the south and the Cherokee Creek pasture to the north. Both pastures are grazed by sheep and cattle on a seasonal rotation. In year one, sheep are grazed in the spring and cattle are grazed in the summer. In year two, cattle are grazed in the spring and sheep are grazed in the fall.

Land Use

Land use adjacent to the BCII PA includes agricultural activities, wildlife habitat, oil and natural gas exploration, and dispersed outdoor recreation. Agricultural activities are primarily related to cattle and sheep grazing.

3.8 WILDLIFE

The BCII PA is located in the sagebrush steppe plant community that is typical of the high inter-mountain desert of south-central Wyoming. The primary vegetation type in the BCII PA is mountain big sagebrush. The BCII PA includes approximately 3,058 acres of sagebrush steppe/mixed grass wildlife habitat. Many common species of birds, mammals, amphibians, and reptiles are found within the BCII PA. The analysis area for the greater sage-grouse consisted of the BCII PA plus a two-mile buffer. The analysis area for raptors included the BCII PA plus a one-mile buffer. **Figures 3-5** through **3-7** show the locations of critical wildlife resources located within and adjacent to the BCII PA.

Information regarding the potential occurrence of Federally-listed threatened or endangered species, species of concern, big game, raptors, and greater sage-grouse on and adjacent to the BCII PA was obtained from several sources. Greater sage-grouse lek locations, seasonal big game range designations, and locations of threatened and endangered species were obtained from the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System (WOS), WGFD regional biologists, the BLM, and the WYNDD. The WGFD big game herd unit annual reports were used for herd unit population statistics. Greater sage-grouse lek and raptor nest locations were obtained from the WGFD and the BLM RFO.

Existing wildlife information for the BCII PA was also supplemented through survey data collected by Hayden-Wing Associates (HWA) biologists between 2001 and 2004. Wildlife surveys performed by HWA from 2001-2003 were conducted as part of larger-scale surveys being performed in preparation for the Atlantic Rim EIS. Wildlife field work included: (1) a helicopter survey to determine the status of nesting raptors, (2) ground-truthing and mapping of white-tailed prairie dog towns, (3) the identification and mapping of potential mountain plover habitat, and (4) a helicopter survey to locate habitat areas being used by greater sage-grouse during severe winter conditions. Surveys for presence/absence of mountain plover were conducted in potential habitat areas for three consecutive years from 2001-2003. In addition, the BLM RFO continues to update plover data yearly. Information regarding the potential occurrence of sensitive species within the BCII PA was also obtained from the WYNDD.

Figure 3-5
General Wildlife

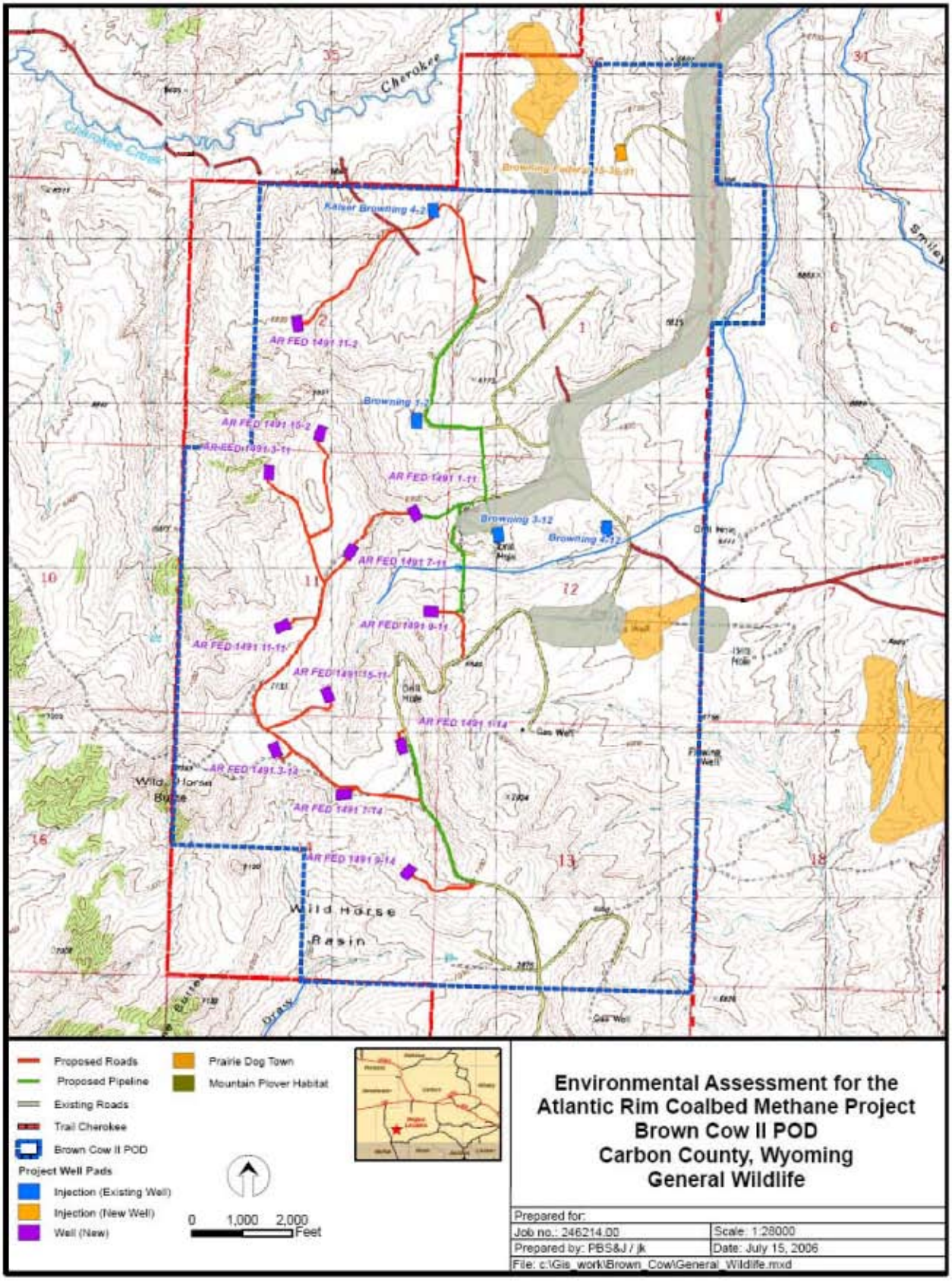


Figure 3-6
Sage Grouse Leks

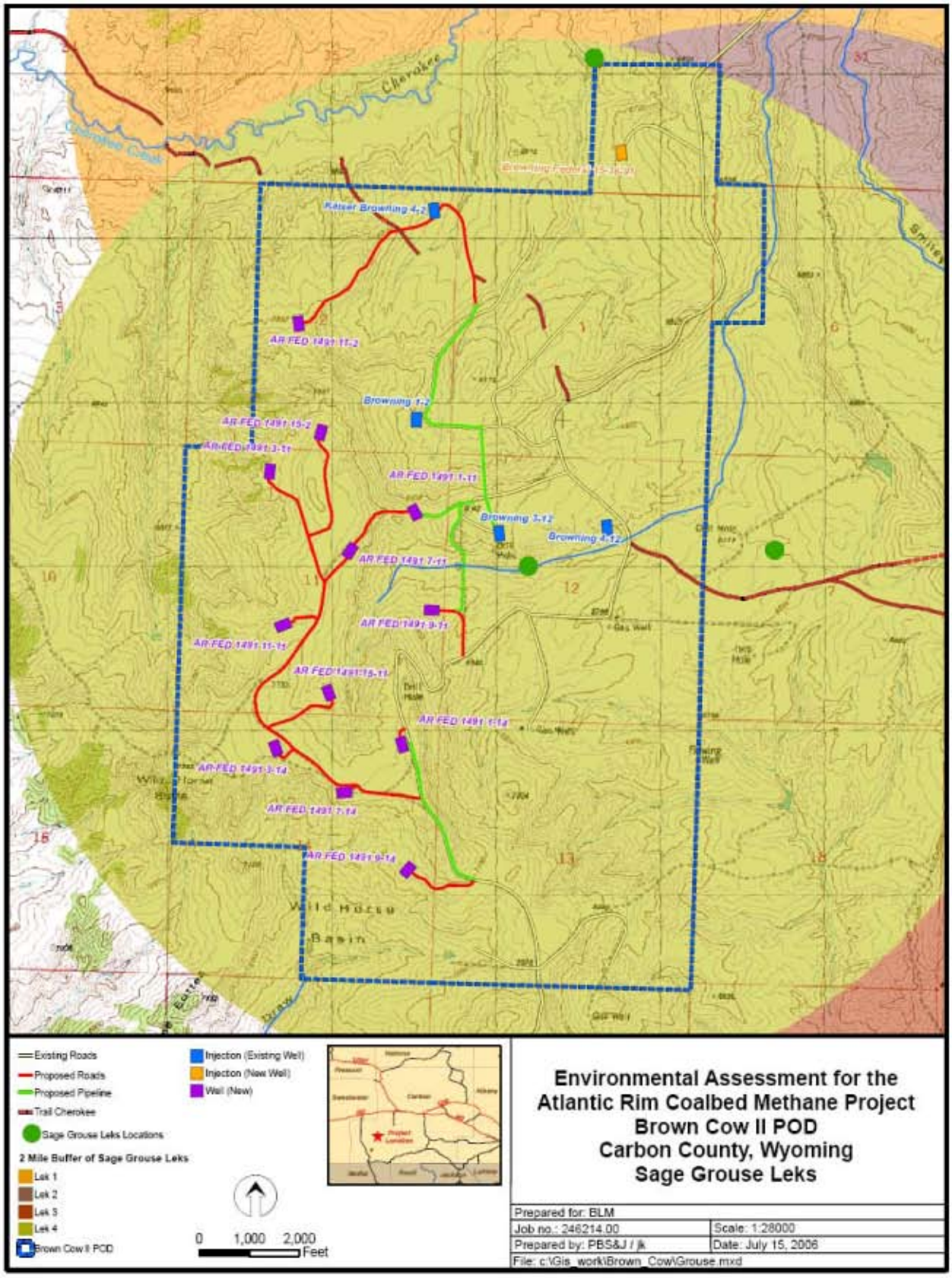
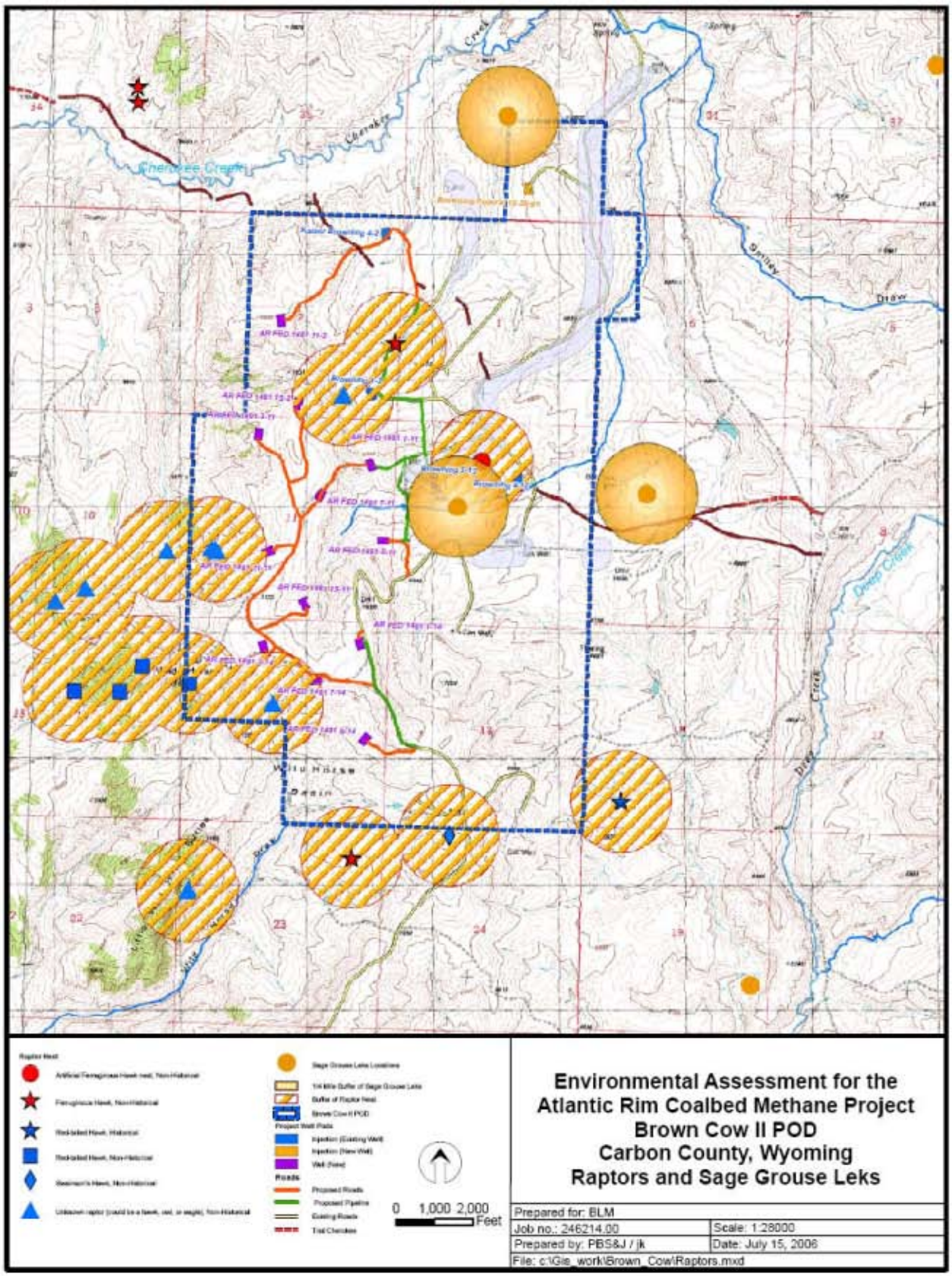


Figure 3-7
Raptors and Sage Grouse Leks



3.8.1 Big Game

Three big game species – pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*) – utilize the BCII PA during the year. Three seasonal ranges, designated by the WGFD, occur within the BCII PA: crucial winter/yearlong, winter, and winter/yearlong. Crucial big game range (e.g. crucial winter/yearlong range) includes any seasonal range or habitat component that has been documented as a determining factor in a population's ability to maintain itself at a specified level over the long-term. Winter ranges are used by substantial numbers of animals only during the winter months (November through April). Winter/yearlong ranges are occupied throughout the year, but during winter there is a significant influx of additional animals into the area from other seasonal ranges. No spring/summer/fall ranges have been documented by the WGFD within the BCII PA.

3.8.1.1 Pronghorn Antelope

The BCII PA is located within the 1,394-square mile Baggs Pronghorn Antelope Herd Unit and the entire BCII PA (3,692 acres) has been designated winter/yearlong range (see **Figure 3-8**). The 2004 population estimate for the Baggs Herd Unit was 11,300 animals, which was 26% above the objective of 9,000 (WGFD 2004a). The BCII PA is located within Hunt Area 55, where the hunter success rate in 2004 was 93.3%.

3.8.1.2 Mule Deer

The BCII PA is located within the 3,440-square mile Baggs Mule Deer Herd Unit, which contains habitats ranging from subalpine and montane coniferous forests to desert scrub. The northeastern and northwestern portions of the BCII PA are within winter/yearlong range (2,070 acres) and the southwestern portion of the BCII PA (1,622 acres) is within crucial winter/yearlong range (see **Figure 3-9**). According to data gathered by Western Ecosystems Technology, Inc. (WEST) (2006), the BCII PA received both winter and transition use by mule deer with many deer migrating through the western half of the BCII PA to reach their summer ranges. Deer wintering in the Wild Horse/Muddy Mountain area appeared to use consistent migration routes through the BCII PA and north to transition ranges in the Sandhills and/or the Wild Cow/Deep Gulch areas (WEST 2006). The 2004 population estimate for the Baggs Herd Unit was 21,000 animals, which is 12% above the WGFD management objective of 18,700 (WGFD 2004a). The BCII PA is located within Hunt Area 82, where the hunter success rate in 2004 was 61.6%.

3.8.1.3 Elk

The BCII PA is located within the 2,425-square mile Sierra Madre Elk Herd Unit. Most elk in the herd unit utilize spring/summer/fall ranges in the Sierra Madre Mountains, although there are groups using habitats on the ARPA and around McCarty Canyon. During winter, the elk migrate to lower elevation winter range habitats on the west side of the Sierra Madre Mountains and into the ARPA/Sand Hills areas. **Figure 3-10** illustrates the elk's ranges. Some animals may migrate as far west as the Powder Rim (approximately 40 miles west of Baggs, Wyoming; Porter 1999); however, no major elk migration routes pass through the BCII PA. Almost the entire BCII PA (3,688.7 acres) is classified as elk winter range; the extreme northeast corner of the BCII PA (3.3 acres) is classified as winter/yearlong range. The 2004 population estimate for the Baggs Herd Unit was 11,200 animals, which is 143% above the WGFD management objective of 4,200

(WGFD 2004a). The BCII PA is located within Hunt Area 108, where the hunter success rate in 2004 was 76%.

Figure 3-8
Antelope Seasonal Range

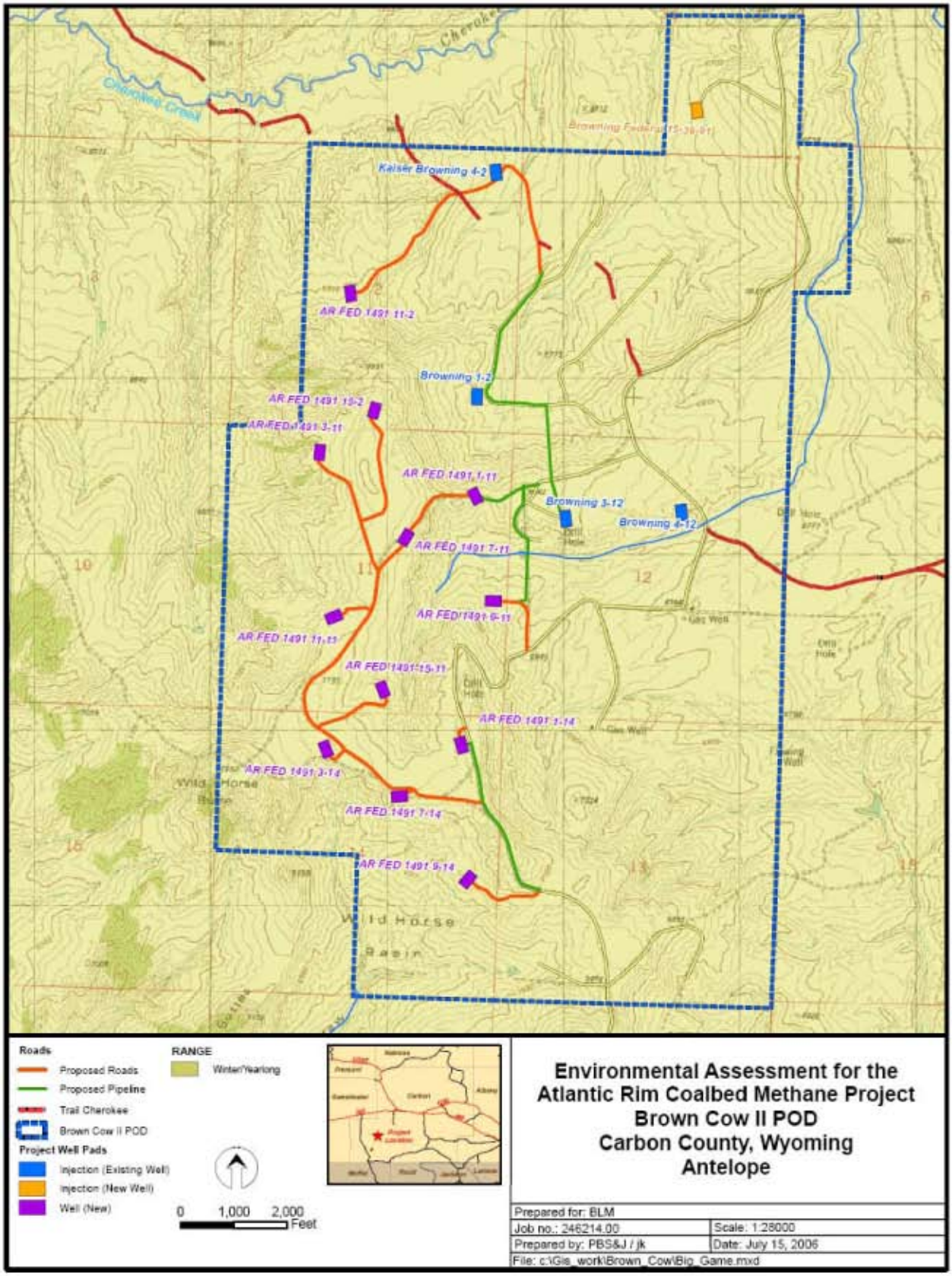


Figure 3-9
Mule Deer Seasonal Range

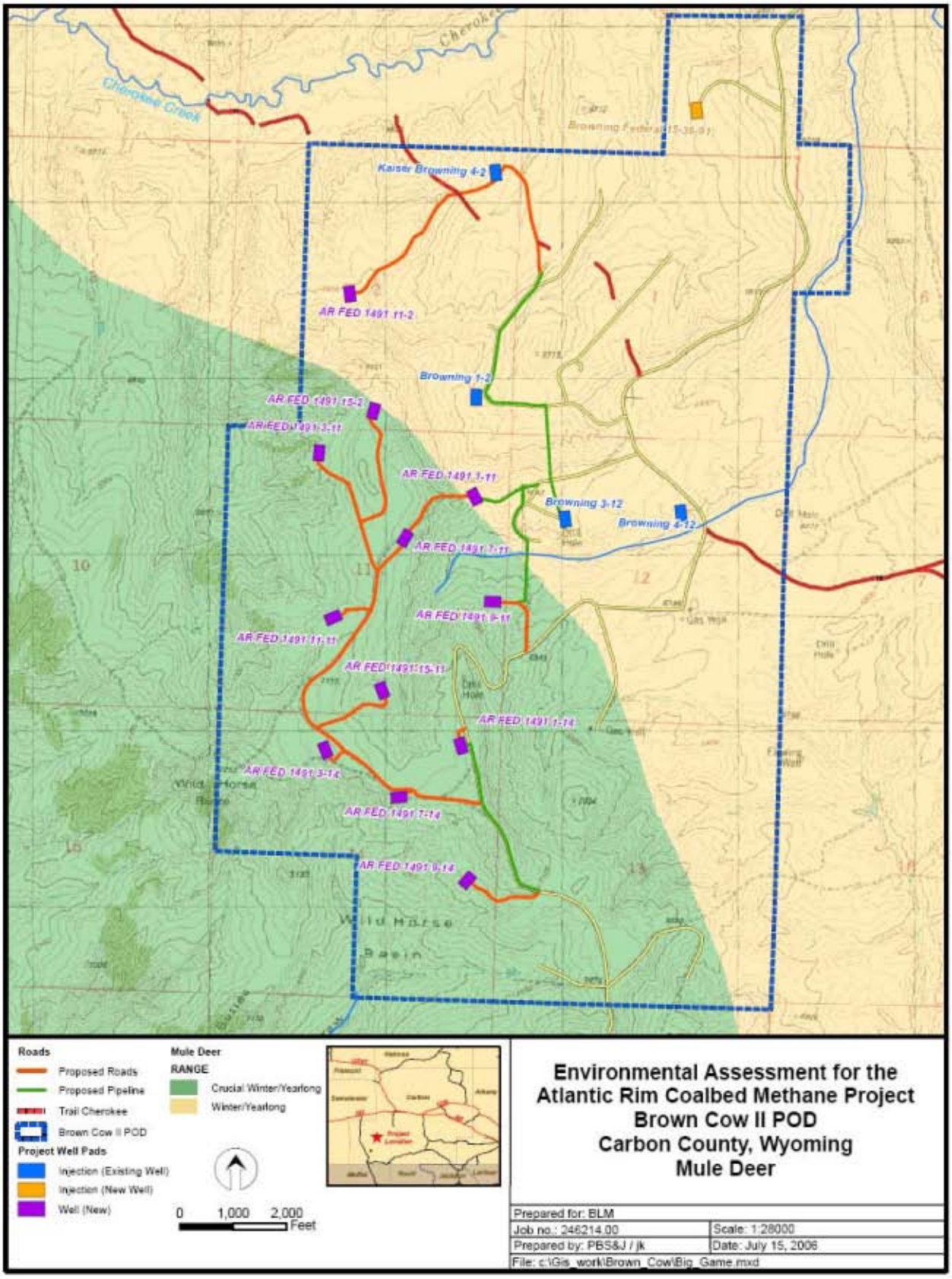
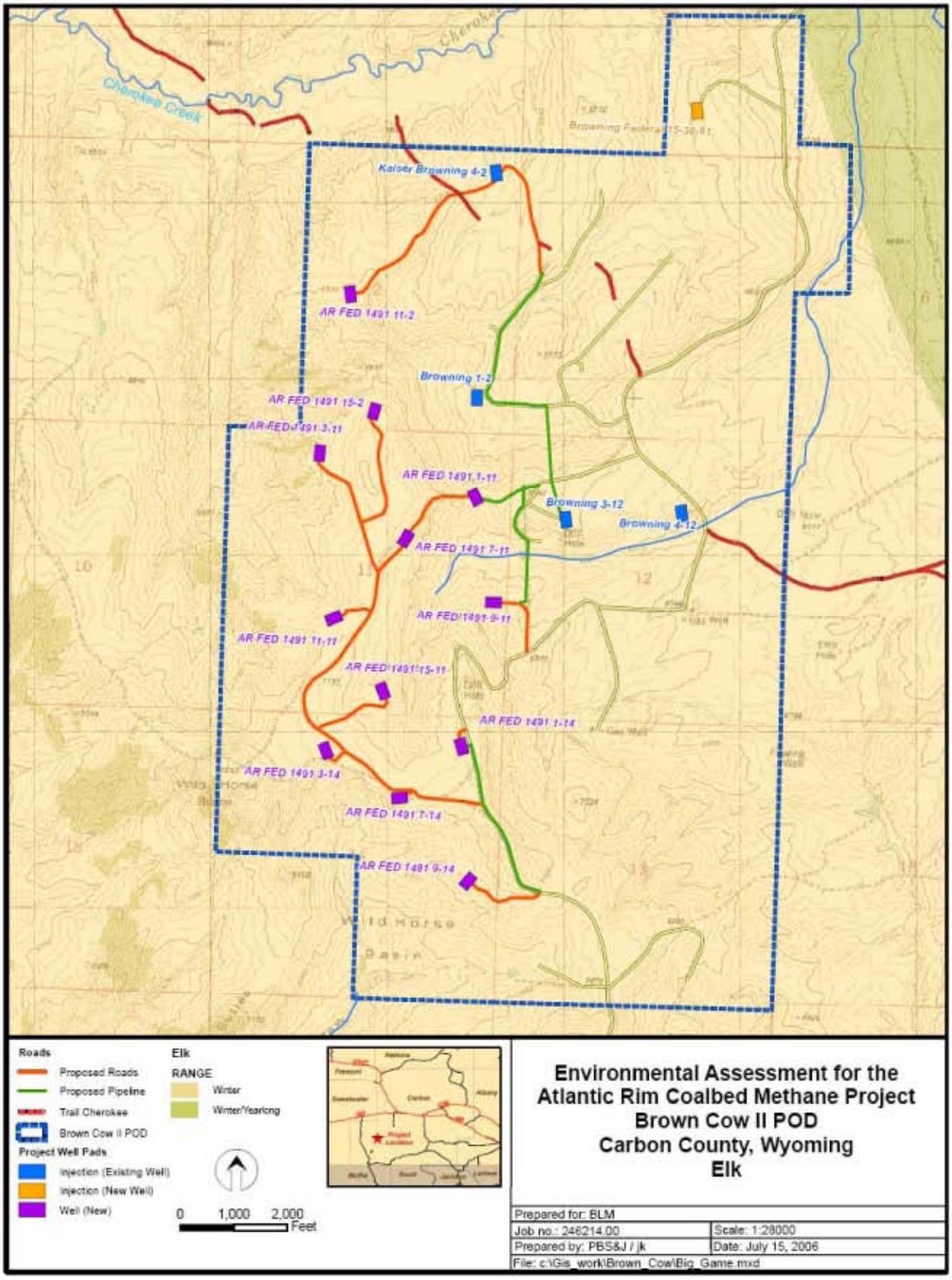


Figure 3-10
Elk Seasonal Range



3.8.2 Upland Game Birds

3.8.2.1 Greater Sage-Grouse

The BCII PA is located within the extensive sagebrush/grassland habitat of south-central Wyoming, where greater sage-grouse (*Centrocercus urophasianus*) are common inhabitants. Strutting grounds (leks), nesting, brood-rearing, and wintering habitats are all important habitat components required by greater sage-grouse. Sometimes these habitats are contiguous and other times occur in a patchy, disconnected pattern (Call and Maser 1985). Approximately 50% of greater sage-grouse hens usually nest within two miles of leks (Braun *et al*. 1977, Hayden-Wing *et al*. 1986, Wakkinen *et al*. 1992, Wallestad and Pyrah 1974). As a result, any sagebrush habitat within two miles of a lek is considered potential nesting habitat. In response to petitions to list the greater sage-grouse under the ESA, the FWS completed a status review of this species throughout its range and, on January 7, 2005, determined that it did not warrant protection under the ESA. However, the greater sage-grouse is considered a sensitive species by the BLM in Wyoming.

The BCII PA is located within the Sierra Madre Upland Game Management Area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 2004, 954 greater sage-grouse were harvested in Area 25, providing 920 hunter recreation days (WGFD 2004b). The Sierra Madre Upland Game Management Area accounted for approximately 8% of the state-wide harvest of greater sage-grouse in 2004.

Based upon surveys conducted by the WGFD, BLM, and HWA, there are four occupied leks within two miles of the BCII PA (see **Figures 3-6** and **3-7**). The WGFD defines an occupied lek as one that has been active during at least one strutting season within the last 10 years. Management protection is afforded to occupied leks and the entire BCII PA is located within two miles of greater sage-grouse leks; therefore, the BCII PA is subject to seasonal restrictions to protect nesting greater sage-grouse. Survey results from 2000-2005 for leks have been summarized in **Table 3-14**. Sage-grouse lek observation history reports were obtained from the WGFD.

Table 3-14
Sage Grouse Lek Observation Summary (2000 – 2005)

Lek	Year	Number of Observations	Maximum Males Counted	Average Males Counted	Maximum Females Counted	Average Females Counted	Lek Status
25-Cherokee Creek 2	2005	4	125	112	119	37	Occupied and active in 2005
	2004	5	86	65	71	15	
	2003	4	71	54	64	21	
	2002	6	85	42	7	36	
	2001	4	96	45	21	6	
	2000	2	61	34	51	25	
25- Wild Horse Mountain	2005	No Birds Located					Occupied- Last sign of activity observed in 1999
	2004	Not Checked					
	2003	Not Checked					
	2001	No Birds Located					
	2000	Not Checked					
25-Wild Horse Basin 3	2005	Not Checked					Occupied- Last sign of activity observed in 2001
	2004	No Birds Located					
	2003	Not Checked					
	2002	Not Checked					
	2001	20 Birds Observed- Sex Unknown					
	2000	Not Checked					
25-Wild Horse Basin 2	2005	2	107	104	22	12	Occupied and active in 2005
	2004	Not Checked					
	2003	Not Checked					
	2002	2	31	15	0	0	
	2001	45 Birds Observed- Sex Unknown					
	2000	Not Checked					

3.8.2.2 Raptors

Raptor species that may occur on or near the BCII PA include the golden eagle, bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl.

Raptor nest data was obtained from the BLM RFO Raptor Monitoring Program, which was developed to track and document nest locations and apply stipulations for ground disturbance. Raptor data was last updated by the BLM in September 2005. The analysis area for raptors included the BCII PA plus a one-mile buffer.

Based upon data obtained from the BLM RFO, 19 raptor nests (five ferruginous hawk, four red-tailed hawk, one artificial ferruginous hawk, one Swainson's hawk, and eight unknown nests) were documented within the analysis area and are shown on **Figure 3-7**. An unknown raptor nest could be a hawk, owl, or eagle nest. All 19 nests have been mapped as "non-historical," which is defined as a nest that still presents a nesting opportunity.

3.8.3 Special Status Species – Wildlife

Special status species include Federal threatened, endangered, and candidate species listed by the USFWS under the ESA. The USFWS has determined that three wildlife species listed as threatened, endangered, or candidate under the ESA may potentially be found on lands administered by the RFO. These species are the threatened bald eagle (*Halieaeetus leucocephalus*), endangered black-footed ferret (*Mustela nigripes*), and the threatened Canada lynx (*Lynx canadensis*) (USDI-FWS 2003).

3.8.3.1 Threatened and Endangered Species – Wildlife

Black-Footed Ferret and Associated White-Tailed Prairie Dog Colonies

The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). In Wyoming, white-tailed prairie dog (*Cynomys leucurus*) colonies provide habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising their young (Fagerstone 1987).

Prairie dog colonies within the BCII PA were mapped during the summers of 2000 and 2001, though both are incomplete. The boundaries of two prairie dog colonies were mapped using a handheld Global Positioning System unit and an all-terrain vehicle and the locations of these colonies are shown on **Figure 3-5**. One colony, totaling 24.9 acres, is located in the eastern portion of the BCII PA. This colony is located in a block-cleared zone; therefore, black-footed ferret surveys are not necessary. One colony, totaling 43.6 acres, was mapped in the northern section of the BCII PA; this colony is not in a block-cleared zone. According to USFWS guidelines (2004), prairie dog complexes greater than 200 acres in size that contain colonies within 4.3 miles of each other represent potential habitat for black-footed ferrets. Neither of the colonies located in the BCII PA meet these criteria; therefore, black-footed ferret surveys are not necessary. In addition, whenever possible, project features were re-located to avoid prairie dog colonies.

A search of the WGFD database determined that there are no documented occurrences or sightings of black-footed ferrets within the BCII PA. A black-footed ferret survey was not conducted within the 43.6-acre colony.

Canada Lynx

Records of Canada lynx in Wyoming indicate that most lynx or signs of lynx between 1973 and 1986 were in spruce-fir (41%) and lodgepole pine (18%) communities (Reeve *et al*. 1986). According to Reeve *et al*. (1986), more than 50% of lynx records in Wyoming occurred in the northwestern region of the State. The closest a lynx was recorded to the BCII PA was near the Medicine Bow River in 1856 (Reeve *et al*. 1986); there have been no recorded sightings or signs of lynx in Carbon County since then.

A search of the WGFD database determined that there are no documented occurrences or sightings of Canada lynx within the BCII PA. It is highly unlikely that lynx occur in the BCII PA because: (1) the BCII PA does not include high elevation lodgepole pine/spruce-fir habitat types preferred by the species, (2) it does not support a population of snowshoe hares (preferred prey item), (3) there are no recorded lynx sightings near the BCII PA, and (4) the closest potential habitat (lynx analysis unit (LAU)) is more than 10 miles away in the Sierra Madre Mountains.

Bald Eagle

Primary bald eagle wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen, where fish and waterfowl are available, and near ungulate winter ranges that provide carrion (Montana Bald Eagle Working Group 1990). Wintering bald eagles are also known to roost in forests with large, open conifers and snags protected from wind by ridges, often near concentrations of domestic sheep and big game (Anderson and Patterson 1988).

A search of the WGFD database did not locate any recorded occurrences or sightings of bald eagles within the BCII PA. No communal bald eagle winter roosts are known to exist on or near the BCII PA. Review of BLM and raptor nest records as well as results of aerial and ground raptor nest surveys conducted by HWA reveal that no bald eagle nests occur within a two-mile radius of the BCII PA. The closest known nest is located approximately 18 miles southwest of the BCII PA in Section 11, T12N – R93W (Cerovski 2000). There is a potential for bald eagles to forage in the vicinity of the BCII PA, but would be unlikely due to the lack of associated habitat.

3.8.4 Species of Concern – Wildlife

The objective of the sensitive species designation is to ensure the overall welfare of the species is considered when undertaking actions on public lands and to ensure they do not contribute to the need to list the species under the provisions of the ESA. It is the intent of this policy to emphasize the inventory, planning consideration, management implementation, monitoring, and information exchange for the sensitive species on the list. The BLM Sensitive Species List for Wyoming is meant to be dynamic and will be reviewed annually with recommendations from BLM biologists and appropriate non-BLM authorities for additions and deletions (USDI-BLM 2002). Additionally, the WYNDD was reviewed on January 18, 2006 for potential occurrences of species of concern within the BCII PA (WYNDD 2005). In total, 29 species (six mammals,

16 birds, three amphibians, and four fish) occur on the RFO Sensitive Species List. **Table 3-15** lists the species of concern potentially occurring in the BCII PA.

Mammals

Six sensitive mammal species may potentially be found on or near the BCII PA. These include: Wyoming pocket gopher, white-tailed prairie dog, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat. Only one of these species, the white-tailed prairie dog, is known to occur within the BCII PA; two small towns (68.5 acres total) occur in the project area. The remaining species - Wyoming pocket gopher, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat - have a slight potential to occur on or adjacent to the BCII PA.

Additionally, the western small-footed myotis, silver-haired bat, Hoary bat, Wyoming ground squirrel, ringtail, and the black-footed ferret are listed by the WYNDD. Of these, the Hoary bat, Wyoming ground squirrel, and black footed ferret my potentially occur in the BCII PA. It is unlikely that the western small-footed myotis, silver-haired bat, and ringtail because there is no suitable habitat for these species within the BCII PA.

Birds

Sixteen sensitive bird species may potentially be found on or near the BCII PA. These include: Baird's sparrow, Brewer's sparrow, long-billed curlew, western burrowing owl, yellow-billed cuckoo, loggerhead shrike, Columbian sharp-tailed grouse, greater sage-grouse, white-faced ibis, trumpeter swan, peregrine falcon, ferruginous hawk, mountain plover, and the northern goshawk. The western subspecies of yellow-billed cuckoo is considered a FWS candidate for listing as endangered. The WYNDD has also listed the golden eagle, merlin, sandhill crane, snowy plover, American avocet, short-eared owl, ash throated flycatcher, western scrub-jay, juniper titmouse, canyon wren, black-throated gray warbler, chestnut-collared longspur, and Scott's oriole to potentially occur in the BCII PA (WYNDD 2005). The yellow-billed cuckoo, white-faced ibis, northern goshawk, and trumpeter swan are unlikely to occur on or near the BCII PA.

The Brewer's sparrow, sage sparrow, sage thrasher, greater sage-grouse and Ferruginous hawk are known to be present within the BCII PA.

One ferruginous hawk nest is located in the northern portion of the BCII PA adjacent to an existing road. Two ferruginous hawk nests were found to be located directly south of the BCII PA boundaries and two are located north of the project boundaries. Additionally, eight unknown raptor nests were located within the project area. There is a possibility that these nests could be of hawk, owl, or eagle origin.

There is a possibility that the Baird's sparrow, burrowing owl, chestnut-collared longspur, Columbian sharp –tailed grouse, golden eagle, loggerhead shrike, long-billed curlew, merlin, mountain plover, peregrine falcon, sage sparrow, sage thrasher and short-eared owl may occur in the BCII PA.

Due to a lack of suitable habitat, it is unlikely that the American avocet, ash-throated flycatcher, black-throated gray warbler, canyon wren, juniper titmouse, Scott's oriole, snowy plover, trumpeter swan, western scrub-jay, white-faced ibis and the yellow-billed cuckoo would occur in the BCII PA.

Amphibians

Three sensitive amphibian species may potentially be found on or near the BCII PA. These include: boreal toad, Great Basin spadefoot toad, and northern leopard frog. The WYNDD lists the tiger salamander and great basin spadefoot toad as potentially occurring in the BCII PA. All five species are unlikely to occur on the BCII PA due to the absence of wetlands and water bodies.

Reptiles

One sensitive reptile species, the northern plateau lizard is listed as likely to occur within the BCII PA by WYNDD. There is a possibility of this species being found within the project boundaries.

Fish

The roundtail chub, bluehead sucker, flannelmouth sucker and Colorado River cutthroat are listed by the RFO Sensitive Species list to potentially occur in the BCII PA. No fish are found in the BCII PA due to the lack of any perennial streams.

Table 3-15
Sensitive Wildlife and Fish Species Potentially Present On or Near the BCII PA

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Mammals				
Black-footed ferret	*Mustela nigripes*	G1/S1	In or near prairie dog colonies, generally on short or mixed-grass prairies.	Possible
Fringed myotis	*Myotis thysanodes*	R2, G5/S1B, S1N, NSS2	Conifer forests, woodland-chaparral, caves and mines.	Possible
Hoary bat	*Lasiurus cinereus*	G5/S4	Shrublands, grasslands, and aspen-pine forests near roosting habitat (deciduous trees).	Possible
Long-eared myotis	*Myotis evotis*	G5/S1B, S1N, NSS2	Conifer and deciduous forests, caves and mines.	Unlikely
Ringtail	*Bassariscus astutus*	G5/S1	Near water, dense riparian, conifer, pinyon-juniper, deserts, shrubsteppe.	Unlikely
Silver-haired bat	*Lasionycteris noctivagans*	G5/S3	Wide variety of habitats Roosts: trees, caves, mines.	Unlikely

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Swift fox	*Vulpes velox*	R2, G3/S2A3	Grasslands.	Possible
Townsend's big-eared bat	*Corynorhinus townsendii*	R2/R4, G4/S1B, S2N, NSS2	Forests, basin-prairie shrub, caves and mines.	Possible
Western small-footed myotis	*Myotis ciliolabrum*	G5/S3	Montane forests, sage steppes, and shortgrass prairie Roosts: caves, mines.	Unlikely
White-tailed prairie dog	*Cynomys leucurus*	G4/S2S3, NSS3	Basin-prairie shrub, grasslands.	Present
Wyoming ground squirrel	*Spermophilus elegans*	G5/S3S4	Open habitats from sage grasslands to alpine meadows.	Possible
Wyoming pocket gopher	*Thomomys clusius*	R2, G2/S1S2, NSS4	Meadows with loose soil.	Possible
Birds				
American avocet	*Recurvirostra americana*	G5/S3B	Marshes, ponds, and shores, esp. alkaline areas.	Unlikely
Ash-throated flycatcher	*Myiarchus cinerascens*	G5/S3B	Juniper woodlands.	Unlikely
Baird's sparrow	*Ammodramus bairdii*	G4/S1B, SZN, FSR2, TBNG	Grasslands, weedy fields.	Possible
Black-throated gray warbler	*Dendroica nigrescens*	G5/S2	Juniper woodlands.	Unlikely
Brewer's sparrow	*Spizella breweri*	G5/S3B, SZN	Basin-prairie shrub.	Present
Burrowing owl	*Athene cunicularia*	R2, G4/S3B, SZN, NSS4	Grasslands, basin-prairie shrub.	Likely
Canyon wren	*Catherpes mexicanus*	G5/S2S3	Rocky canyons and cliffs.	Unlikely
Chestnut-collared longspur	*Calcarius ornatus*	G5/S1	Medium height grass, especially meadows around ponds.	Possible
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	G4T3/S1	Brushy areas in prairie country or foothills.	Likely

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Ferruginous hawk	*Buteo regalis*	R2, G4/S3B, S3N, NSS3	Basin-prairie shrub, grassland, rock outcrops.	Present
Golden eagle	*Aquila chrysaetos*	G5/S3B	Open grasslands and shrublands especially around cliffs and canyons.	Likely
Greater sage-grouse	*Centrocercus urophasianus*	G5/S3	Basin-prairie shrub, mountain foothill shrub.	Present
Juniper titmouse	*Baeolophus ridgwayi*	G5/S1	Juniper woodlands.	Unlikely
Loggerhead shrike	*Lanius ludovicianus*	G5/S4B, SZN, R2	Basin-prairie shrub, mountain foothill shrub.	Likely
Long-billed curlew	*Numenius americanus*	G5/S3B, SZN, R2, NSS3	Grasslands, plains, foothills, wet meadows.	Possible
Merlin	*Falco columbarius*	G5/S4	Open woodlands, grasslands, and shrublands, sometimes in cities in winter.	Possible
Mountain Plover	*Charadrius montanus*	G2/S2B, SZN	Sparse shortgrass or mixed grass prairie. Also in short sagebrush plains. Often associated with prairie dog towns.	Likely
Northern goshawk	*Accipiter gentiles*	R2/R4, G5/S23B, S4N, NSS4	Conifer and deciduous forests.	Unlikely
Peregrine falcon	*Falco peregrinus*	G4/T3/S1B, S2N, R2, NSS3	Tall cliffs.	Possible
Sage sparrow	*Amphispiza belli*	G5/S3B, SZN	Basin-prairie shrub, mountain foothill shrub.	Present
Sage thrasher	*Oreoscoptes montanus*	G5/S3B, SZN	Basin-prairie shrub, mountain-foothill shrub.	Present
Sandhill crane	*Grus canadensis*	G5/S3B, S5N	Meadows, marshes, shorelines, and grain fields.	Possible
Scott's oriole	*Icterus parisorum*	G5/S1	Juniper woodlands.	Unlikely

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Short-eared owl	*Asio flammeus*	G5/S2	Open grasslands, meadows, marshes, and farmland, especially around tall grass or weeds.	Possible
Snowy plover	*Charadrius alexandrinus*	G4/SA	Sandy beaches and shores of alkaline ponds.	Unlikely
Trumpeter swan	*Cygnus buccinator*	R2/R4, G4/S1B, S2N, NSS2	Lakes, ponds, rivers.	Unlikely
Western scrub-jay	*Aphelocoma californica*	G5/S1	Juniper woodlands.	Unlikely
White-faced ibis	*Plegadis chihi*	G5/S1B, SZN, R2, NSS3	Marshes, wet-meadows.	Unlikely
Yellow-billed cuckoo	*Coccyzus americanus*	G5/S2B, SZN, FSR2, TBNG, NSS2	Open woodlands, streamside willow and alder groves.	Unlikely
Amphibians				
Boreal toad	*Bufo boreas boreas*	G4T4/S2, R2, R4, NSS2	Pond margins, wet meadows, riparian areas.	Unlikely
Great Basin spadefoot toad	*Spea intermontanus*	G5/S4, NSS4	Spring seeps, permanent and temporary waters.	Unlikely
Northern leopard frog	*Rana pipiens*	G5/S3, R2, NSS4	Beaver ponds, permanent water in plains and foothills.	Unlikely
Tiger salamander	*Ambystoma tigrinum*	G5/S4	Fairly moist environments ranging from rodent burrows, window wells, to burrows in sand dunes. Larvae found in intermittent streams, ponds, and lakes.	Unlikely

Common Name	Scientific Name	Sensitivity Status[1]	Habitat	Occurrence Potential[2]
Reptiles				
Northern many-lined skink	*Eumeces multivirgatus*	G5/S1	Grassland communities or open scarp woodlands, on the ground and often hiding under loose objects (boards, logs, rocks, etc.).	Possible
Northern plateau lizard	*Sceloporus undulates elongtus*	G5T5/S1	Near rocky outcrops and canyon walls in sagebrush communities, in association with the sagebrush lizard.	Likely
Fish				
Bluehead sucker	*Catostomus discobolus*	G4/S2S3, NSS1	Bear, Snake and Green drainages, all waters.	Unlikely
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	R2/R4, G4T2T3/S2, NSS2	CO River drainage, clear mountain streams.	Unlikely
Flannelmouth sucker	*Catostomus latipinnis*	G3G4/S3, NSS1	CO River drainage, large rivers, streams and lakes.	Unlikely
Roundtail chub	*Gila robusta*	G2G3/S2?, NSS1	CO River drainage, mostly large rivers, also streams and lakes.	Unlikely

Sources: USDI-BLM (2002), WYNDD (2005).

Notes:

[1] *Definition of status:*

G Global rank: Rank refers to the range-wide status of a species.

T Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.

S State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.

1 Critically imperiled because of extreme rarity (often known from five or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.

2 Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.

3 Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).

4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.

5 Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

H Known only from historical records. 1950 is the cutoff for plants; 1970 is the cutoff date for animals.

X Believed to be extinct.

A Accidental or vagrant: A taxon that is not known to regularly breed in the state or which appears very infrequently (typically refers to birds and bats).

B Breeding rank: A state rank modifier indicating the status of a migratory species during the breeding season (used mostly for migratory birds and bats)

N Nonbreeding rank: A state rank modifier indicating the status of a migratory species during the non-breeding season (used mostly for migratory birds and bats)

ZN or ZB Taxa that are not of significant concern in Wyoming during breeding (ZB) or non-breeding (ZN) seasons. Such taxa often are not encountered in the same locations from year to year.

U Possibly in peril, but status uncertain; more information is needed.

Q Questions exist regarding the taxonomic validity of a species, subspecies, or variety.

? Questions exist regarding the assigned G, T, or S rank of a taxon.

R2 Designated sensitive in U.S. Forest Service Region 2 (Rocky Mountain Region).

R4 Designated sensitive in U.S. Forest Service Region 4 (Intermountain Region).

WGFD Native Species Status Codes - Fish and Amphibians

NSS1 Populations are physically isolated and/or exist at extremely low densities throughout range. Habitats are declining or vulnerable. Extirpation appears possible. The Wyoming Game and Fish Commission mitigation category for Status 1 species is "Vital." The mitigation objective for this resource category is to realize "no loss of habitat function." Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.

NSS2 Populations are physically isolated and/or exist at extremely low densities throughout range. Habitat conditions appear to be stable. The Wyoming Game and Fish Commission mitigation category for Status 2 species is also "Vital." The mitigation objective for this resource category is to realize "no loss of habitat function." Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.

NSS3 Populations are widely distributed throughout its native range and appear stable. However, habitats are declining or vulnerable. The Wyoming Game and Fish Commission mitigation category for Status 3 species is "High." The mitigation objective for this resource category is to realize "no net loss of habitat function within the biological community which encompasses the project site." Under these guidelines, it will be important that the project be conducted in a manner that either avoids the impact, enhances similar habitat or results in the creation of an equal amount of similarly valued fishery habitat.

NSS4-7 Populations are widely distributed throughout native range and are stable or expanding. Habitats are also stable. There is no special concern for these species.

WGFD Native Species Status Codes - Birds and Mammals

NSS1 Populations are greatly restricted or declining, extirpation appears possible. On-going significant loss of habitat.

NSS2 Populations are declining, extirpation appears possible; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; ongoing significant loss of habitat.

NSS3 Populations are greatly restricted or declining, extirpation appears possible; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Species is widely distributed; population status or trends are unknown but are suspected to be stable; on-going significant loss of habitat.

NSS4 Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance.

NSS5 Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is stable and not restricted. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS6 Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is stable and not restricted.

NSS7 Populations are stable or increasing and not restricted in numbers and/or distribution; habitat is stable and not restricted.

[2] Occurrence potential based upon presence of suitable habitat, known distribution, WYNDD records, WGFD records, and field surveys.

3.9 RECREATION

Hunting is the primary recreational use of the BCII PA, with secondary use of the lands for pleasure driving and wildlife viewing. There are no official counts of recreational visitors; however, overall use is believed to be low, which may be attributed to low population densities in the BCII PA vicinity. Additionally, low visitation may be related to the lack of high-standard roads in the area. Road improvements associated with the BCII development may increase visitation.

Based on observations by the BLM, it has been determined that recreational use in the BCII PA appears to be steady or on a slight upward trend. Currently, wildlife populations and habitat conditions are favorable for hunting. The number of hunters in the area is limited by the number of hunting licenses available from the WGFD, which depends largely on herd size as compared to target herd size. If herd size declines, so would the number of licenses issued and, correspondingly, hunting pressure.

3.9.1 Hunting

Recreation visitation in the BCII PA occurs primarily during the fall hunting season (September through November). Big game species are found throughout the BCII PA. While most hunters in the BCII PA pursue mule deer, pronghorn, and elk, some sage-grouse and cottontail rabbit hunting also occurs. Rabbit and predator hunting occurs in late fall and winter. Hunting is of local importance as many regional hunters find the BCII PA to be a convenient and economical area to pursue their sport. The area has also gained national recognition for the high-quality big game hunting and many out-of-state hunters find the BCII PA appealing because they are able to hunt multiple big game species from a single camp site.

Due to the lack of water bodies, sport fishing and waterfowl hunting are not conducted within the BCII PA.

3.9.2 Other Recreation

During spring and summer, small numbers of visitors participate in rock collecting, camping, hiking, wildlife observation, outdoor photography, picnicking, pleasure driving, and off-road vehicle use. Pleasure driving occurs seasonally. Wildlife viewing occurs primarily during the fawning season in late May and June. Raptors, sage-grouse, and other birds attract bird watchers. Rock collecting generates a small amount of use. Other recreational activities within

the BCII PA such as camping and off-road vehicle use are often associated with hunting and scouting activities.
The BLM (2000) considers the overall level of recreation use as low, which is attributed to a low number of local residents, distance from major population centers, lack of publicized natural attractions, and poor road conditions into back-country areas. There are no developed recreational facilities within or adjacent to the BCII PA.

3.10 VISUAL RESOURCES

The landscape in the BCII PA is characterized by undulating topography, ranging from 6,600 feet to over 7,000 feet, and numerous small drainages. Panoramic views from Wild Horse Butte and features such as Cherokee Creek, Wild Horse Basin, and numerous springs and basins make the BCII PA visually unique. Typical plant communities in cold deserts include alkali and low sage brush, mixed desert scrub, and grasses and forbs with scattered patches of big sage/rabbit brush on flatter north and east facing slopes, along drainage ways, and in large depressions. These communities create a green and gray-green color palette in early spring which changes to gray-green and buff/ochre in the summer as grasses and forbs cure. The reddish-brown and earth tones of the surrounding geologic formations creates a contrasting background and dominates the color-scape in areas of steep topography. Human presence is evident due to roads, power lines, and oil and gas production facilities throughout the landscape of the BCII PA.

Due to a viewing distance of three to six miles and rolling topography, there is a limited view of the project area from SH 789. Any facilities or activities located on ridge lines or buttes would be visible from an extensive distance. All visitors would be affected by changes to the visual resources.

The BLM's VRM program is responsible for the management of BCII's visual resources. The intent of the VRM program is to preserve scenic values while facilitating resource development where it is appropriate. The BCII PA has been classified by the BLM visual resource management personnel as VRM Class III. The level of change to visual resources allowable within Class III is described in the BLM Manual 8431—Visual Resource Contrast Rating, Appendix 2 – VRM Management Class Objectives. The objective within Class III areas is to partially retain the existing character of the landscape. The level of change allowed in Class III areas to a characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

To maintain VRM Class III standards, BCII facilities would be constructed in a manner that reflects the lines, forms, colors, and textures of the characteristic landscape, so as to not dominate the landscape. Whenever feasible, existing topography and vegetation would be utilized to screen project activities and facilities.

3.11 CULTURAL RESOURCES

3.11.1 Cultural Chronology of Area

Archeological investigations in the Washakie Basin have concluded that the area has been inhabited by humans for at least 10,000 years from the Paleoindian occupation to the present. The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming

Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The Wyoming Basin Chronology is documented in **Table 3-16**.

Table 3-16
Prehistoric Chronology of the Wyoming Basin

Period	Phase	Age (B.P.)
Paleoindian		12,000 – 8,500
Early Archaic	Great Divide	8,500 – 6,500
	Opal	6,500 – 4,300
Late Archaic	Pine Spring	4,300 – 2,800
	Deadman Wash	2,800-2,000/1,800
Late Prehistoric	Uinta	2,000/1,800 – 650
	Firehole	650 – 300/250
Protohistoric		300/250 – 150 A.D.

Paleoindian Period

The oldest period for which there is solid archaeological evidence is the Paleoindian, beginning ca. 12,000 years B.P. and ending around 8,500 B.P. This is the transition period from the periglacial conditions of the Wisconsin ice advance during the terminal Pleistocene to the warmer and drier climatic conditions of the Holocene. Paleoindian sites are rare in southwest Wyoming. However, isolated surface finds of Paleoindian projectile points are not uncommon and suggest that site preservation may be a major factor affecting the number of known sites.

Archaic Period

Settlement and subsistence practices in southwest Wyoming remained largely unchanged from the end of the Paleoindian period through the Archaic and continued until at least the introduction of the horse, or even until Historic Contact. Reduced precipitation and warmer temperatures occurred ca. 8,500 B.P. The environmental change at the end of the Paleoindian period led to a pattern of broad spectrum resource exploitation which is reflected in the subsistence and settlement practices of the Archaic period which became more diverse. The Archaic period is divided into the Early and the Late periods and subdivided in the Great Divide and Opal and the Pine Spring and Deadman Wash phases, respectively. Large side- and corner-notched dart points were used for hunting. The presence of ground stone implements suggests a greater use of plant resources during the Archaic.

Late Prehistoric Period

The Late Prehistoric period lies between 2,000/1,800 B.P. and 300/250 B.P. and is subdivided into the Uinta and the Firehole phases. Large-scale seed processing and an increase in the number of features is noted in the Late Prehistoric period as is the presence of pottery and the introduction of the bow and arrow technology. A characteristic of the Uinta phase is clusters of semi-subterranean structures dating to ca. 1,050 B.P.

3.11.2 Excavation Data

A cultural resources survey was conducted by Western Archaeological Services, Inc. between May and October 2005. Surveys were conducted at the proposed exploratory well pad sites; however, no surveys have yet been conducted at the proposed injection well sites. Cultural resources were found at two proposed well pad sites and all but one of the proposed well pad sites is within the Cherokee Trail viewshed. Please see **Table 3-17** for a summary of the survey findings.

Table 3-17
Summary of Cultural Resources Survey

Well Pad	Survey Date	Findings
AR Federal 1491 15-11	5/10/05	No resources present. Cherokee Trail 1.5 miles north in viewshed.
AR Federal 1491 11-11	5/10/05	No resources present. Cherokee Trail 1.5 miles north in viewshed.
AR Federal 1491 7-11	5/16/05 and 10/17/05	No resources present. Cherokee Trail one mile north in viewshed.
AR Federal 1491 3-14	5/10/05	No resources present. Cherokee Trail 1.5 miles northeast in viewshed.
AR Federal 1491 7-14	5/10/05	No resources present. Cherokee Trail 1.5 miles northeast in viewshed.
AR Federal 1491 1-14	5/16/05	No resources present. Cherokee Trail 1.5 miles northeast in viewshed.
AR Federal 1491 15-2	8/30/05	No resources present. Cherokee Trail one mile northeast in viewshed.
AR Federal 1491 13-11	8/30/05	No resources present. Cherokee Trail one mile northeast in viewshed.
AR Federal 1491 9-11	5/16/05	Small modern sheepherder camp located on access road. No historic artifacts are present. Cherokee Trail one mile northeast in viewshed.
AR Federal 1491 1-11	8/30/05	No resources present. Cherokee Trail 0.5 mile northeast in viewshed.
AR Federal 1491 11-2	8/31/05	Access road crosses the Cherokee Trail. No other historic properties present.
AR Federal 1491 9-14	5/10/05	Cherokee Trail 1.5 miles northeast of project area but out of the viewshed.

3.11.3 Historic Sites

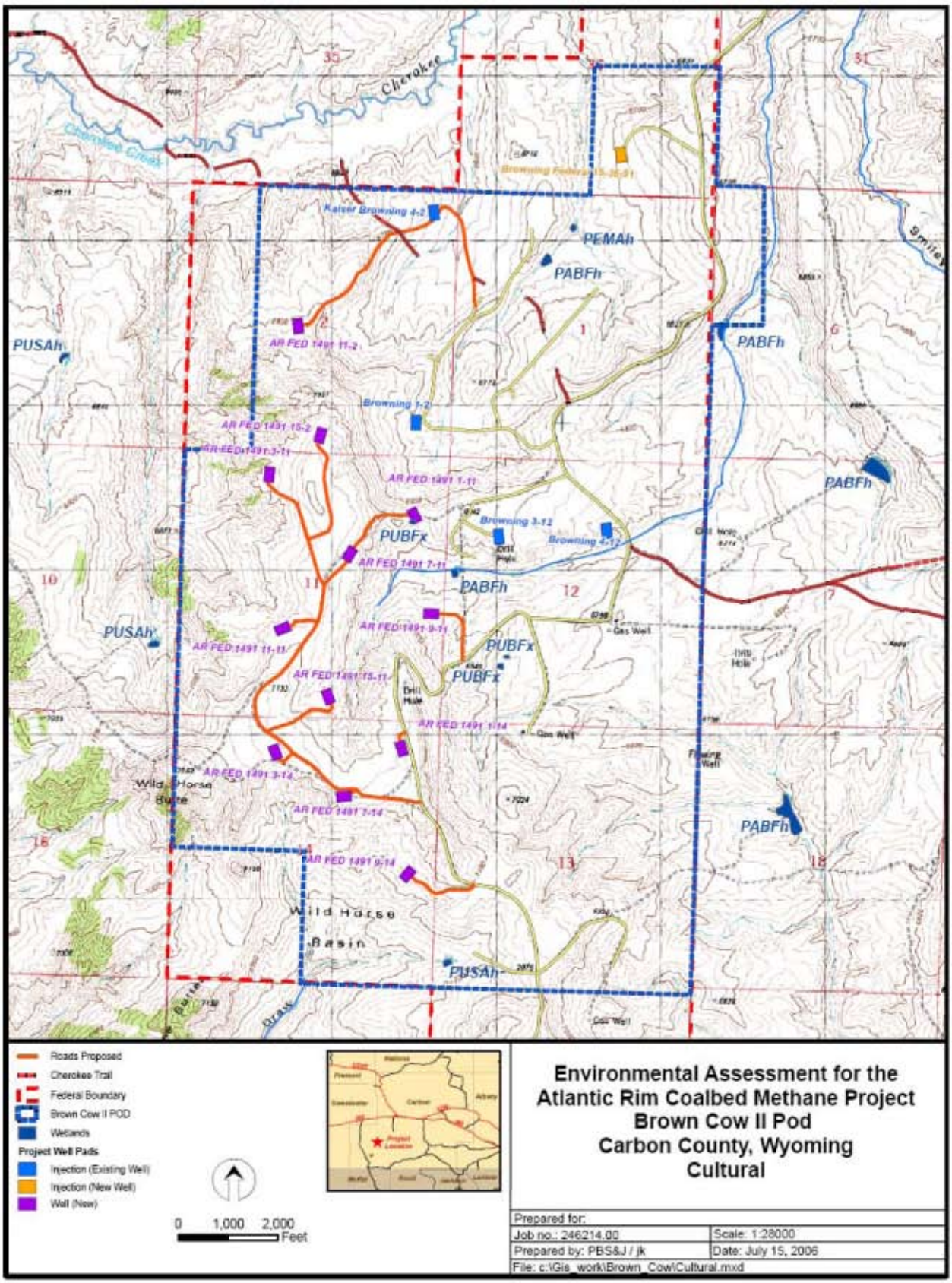
The Cherokee Trail (48SW3680/48CR3651) crosses the northeastern portion of the BCII PA and **Figure 3-11** shows the general location of the Cherokee Trail within the BCII PA. The Cherokee Trail was used by the Cherokee tribe in the 1850s to move from the Oklahoma

Reservation to the California gold fields. From 1851 to 1900 travel along the trail was fully documented by diaries, letters, newspaper accounts, and military and congressional records. The Cherokee Trail provided a north-south corridor for southern frontier states emigrant traffic (Fletcher). A prehistoric sheep herder camp was identified within the BCII PA, which alludes to the historic and prehistoric use of the BCII PA by sheep herders. The identified prehistoric camp site was determined to be not eligible for listing in the National Register of Historic Places.

"The Cherokee Trail has received a great deal of attention by writers as well as the film industry. Louis L'Amour romanticized the trail in his novel *The Cherokee Trail*. And in the 1960s a television series entitled "Cherokee Trail" drew attention to this road through southern Wyoming. The net result of the combined effort of novelists, historians, and the media has been to create a highly romanticized trail that is still not well understood in terms of the people who traveled this trail and the location of the actual route of this road taken by Cherokees traveling west from Oklahoma to California in 1850" (Gardner 1999).

The Cherokee Trail is recommended as eligible for inclusion on the NRHP. As with many historic linear properties, variations have been documented. Inaccessibility at certain times of the year or members of the group finding an easier or more direct avenue to water are possible causes for these variations.

Figure 3-11
Cherokee Trail



3.12 SOCIOECONOMICS

The geographic area of analysis for potential socioeconomic effects is Carbon County, Wyoming, and the nearest communities of Baggs, Dixon, and Rawlins. Socioeconomic conditions in Carbon County that were characterized for the assessment include economic and population conditions, temporary housing resources, certain local and State government revenues, and local attitudes and opinions.

3.12.1 Economic Conditions

The economy of Carbon County is based on natural resources. Basic economic sectors that bring revenues in the county include: oil and gas extraction and processing, coal mining, electric power generation, agriculture (primarily ranching and logging), some manufacturing, and transportation (primarily the Union Pacific railroad). Those portions of the retail and service sectors that serve tourism and recreation visitors are also basic.

Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by exploration or development of CBNG resources.

Employment, like the overall economy, has followed a boom and bust cycle. In 2002, employment in Carbon County totaled 12,392 full- and part-time jobs, which was about 25% higher than the 1990 level (Wyoming Department of Administration and Information [WDAI] 2000a, WDAI 2003) and about 9% lower than the 1980 level of 13,350 jobs. Employment in the mining sector, which includes jobs in the oil and gas industry, decreased 73% from 1990 to 2001, from 934 jobs to 256 jobs. The 2001 level was 93% lower than the 1980 level of 3,563 mining jobs (University of Wyoming [UW] 1997). The losses in the mining sector and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe #2 mines (BLM 1999). Recently, the RAG Shoshone mine near Hanna closed (Rawlins Daily Times 2000). Other reductions in the mine workforce and the delay in opening an anticipated mine have further affected employment in the mining sector throughout the County; however, increases in natural gas drilling has resulted in employment growth in the region in recent years.

In Carbon County, 10-year unemployment rates ranged from a low of 4% in 2000 to a high of 6.1% in 1993. The total 2002 labor force in Carbon County was 8,038, which included 366 unemployed persons, resulting in an unemployment rate of 4.6% (Wyoming Department of Employment 2003).

Carbon County tax earnings increased from $202 million to $211 million between 1990 and 1998, a 5% increase. However, when adjusted for inflation, earnings in Carbon County decreased by 21% from their 1990 level during the eight-year period.

3.12.1.1 Oil and Gas Activities

Production of natural gas in Carbon County increased from approximately 76 million cubic feet in 1995 to approximately 98 million cubic feet in 2002. In addition, 2002 production of oil in Carbon County was 1,714,000 bbls. During 2002, there were 1,191 producing oil and gas wells in Carbon County (WOGCC 2002).

One indicator of future production, approved APDs, increased steadily in Carbon County in recent years, from 50 in 1995, to 162 in 2000, to 280 in 2003, to 330 in 2004, and then dropping slightly to 283 in 2005 (WOGCC 2006). Increased drilling may result in increased production in the County if drilling efforts are successful and commodity prices rise or stabilize at economic levels.

3.12.1.2 Economic Activities

Other economic activities occurring in and near the BCII PA include: oil and gas exploration, cattle grazing, outdoor recreation such as hunting (pronghorn antelope, mule deer, elk, and upland birds), hiking, off-road vehicle use, camping, and sightseeing. There are 19 commercial hunting outfitters that hold permits for the hunting units (elk hunt Area 108, deer hunt Area 82, and antelope hunt Area 55) located in the BCII PA, which comprises only a small portion of the hunting units (Wyoming Board of Outfitters 2006).

3.12.1.3 Population

The growth and decline in the population of Carbon County parallel the employment boom and bust cycle outlined at the beginning of the socioeconomics section. For example, the 2000 population of Carbon County (15,639) was 29% lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538 (see **Table 3-18**). However, the city has recently added population because a new State prison opened. During this period, the Town of Baggs gained 76 residents, or 28% of its 1990 population. Likewise, the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79. The largest population centers in Carbon County are listed in **Table 3-18**.

Table 3-18
Population Centers

County	City	Population 1990	Population 2000	% Change
Carbon	Rawlins	9,380	8,538	-9.0
	Saratoga	1,969	1,726	-12

Source: WDAI 2001.

3.12.2 Temporary Housing Resources

Natural gas development typically involves relatively short-duration tasks carried out primarily by contractors. The nature of these activities results in demand for temporary housing resources such as motel rooms, mobile homes, and recreational vehicle (RV) spaces in the BCII PA and vicinity.

The most convenient access to the BCII PA would be from the communities located along Interstate Highway (IH) 80 in Carbon and Sweetwater Counties. Rawlins is the county seat of Carbon County and the community nearest the BCII PA. Temporary housing includes 19 motels and four RV parks. Motels and RV parks routinely accommodate oil and gas industry workers, as well as tourists, travelers, and hunters. Long-term rental housing in the Rawlins area consists

of 10 apartment complexes and numerous rental houses. According to the 2000 Census, 17.3%, or 667 housing units, of the total 3,860 housing units were rental vacancies.

3.12.3 Local Government and State Government Revenues

The fiscal condition of local and State governments most likely to be affected by interim drilling includes: County, school, and special district ad valorem property tax revenues; State, County, and municipal sales and use tax revenues; State severance taxes; and Federal and State mineral royalty distributions. Some County, municipal, and special district service expenditures may also be minimally affected.

3.12.3.1 Ad Valorem Property Tax

The assessed valuation in Carbon County for fiscal year (FY) 2005 totaled $667.9 million, which yielded total property tax revenues of $41.8 million (WTA 2005). Mineral production is assessed at 100% of value. The countywide mill levy (including countywide and special districts) in 2003 was $4.9 million. Assessed valuation in FY 2005 from 2004 natural gas production totaled $447.1 million, or about 88% of total assessed valuation. Assessed valuation from oil production totaled $56.4 million, or about 13% of total assessed valuation (WDAI 2005).

3.12.3.2 Sales and Use Tax

FY 2005 sales and use tax collections in Carbon County totaled $24.5 million. These collections include a 4% State sales tax and a 1% general purpose local-option sales tax. In addition, Carbon County opted to impose a 1% specific purpose option sales tax during FY 2005 (WDAI 2005).

3.12.3.3 Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the State, including a 6% severance tax on natural gas. In FY 2003, distributions from the severance tax totaled $429 million (WDAI 2004).

3.12.3.4 Federal Mineral Royalties

The Federal government collects a 12.5% royalty on oil and natural gas extracted from Federal lands. After certain costs are deducted, half of those royalties are returned to the state where production occurred. In Wyoming, the State's share is distributed to a variety of accounts, including the university, school foundation fund, highway fund, Legislative Royalty Impact Account, and cities, towns, and counties. During FY 2003, $476 million in Federal mineral royalty funds were distributed to entities in Wyoming (WDAI 2004).

3.12.3.5 State Mineral Royalties

The State of Wyoming collects a 16.7% royalty on the fair market value of gas produced from State leases, less production and transportation costs. During FY 2003, income from State leasing was $52 million (WDAI 2004).

3.12.4 Attitudes and Opinions

A 1996 survey conducted in conjunction with the preparation of the Carbon County Land Use Plan provides some insight into the attitudes and opinions of residents regarding land use, oil and gas development, natural resource conservation and use, and other topics. Slightly more than 300 residents completed the survey, yielding an estimated statistical reliability of about 95% (Pederson Planning Consultants 1998). Water resource conservation and concern for government regulation of land use were the most frequently listed important land use issues. This issue was followed closely by the availability of water to support future land uses; the economic viability of ranching, timber, and oil and gas industries; and the need to conserve wildlife habitat.

Approximately 55% of the countywide survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water, and wildlife resources was more important than increased oil and gas production, while 36.9% indicated that increased oil and gas production was more important. However, 54% of the respondents from the Town of Baggs indicated that increased oil and gas production was more important than conservation of land, water, and wildlife resources, while 36% indicated that resource conservation was more important. The Carbon County Land Use Plan attributes the difference to the greater economic dependence in the Town of Baggs on future employment in the oil and gas industry.

Concerning management of Federal lands, the largest number of respondents (69.5%) indicated that more Federal lands within the County should be designated for conserving fish and wildlife habitat and water resources. In addition, 60.8% of respondents indicated that more land should be designated for public recreation, 48.8% indicated that more land should be leased for oil and gas industry exploration and production, 48.7% indicated that more land should be leased for commercial mining, and 44.5% indicated that more land should be made available to local timber companies for commercial timber harvest.

3.13 TRANSPORTATION

The regional transportation system that serves the BCII PA includes an established network of Interstate and State Highways as well as County Roads. Improved and unimproved BLM roads serve local traffic on Federal land. IH 80 runs from east to west, north of the BCII PA. The BCII PA is accessible from Baggs, Wyoming by traveling approximately 7.5 miles north on SH 789.

3.14 HEALTH AND SAFETY

Some health and safety concerns exist at the BCII PA. Inherent occupational hazards are associated with oil and gas exploration and operation and there are safety issues associated with vehicular travel on unimproved County and BLM roads. The primary recreational activity in the project area is hunting; therefore, there are risks of injury due to firearm accidents. Additionally, there is a low probability of events such as landslides, flash floods, and range fires.

3.15 HAZARDOUS OR SOLID WASTE

According to the BLM's Instruction Memoranda Number WO-93-344, all NEPA documents are required to list any hazardous and/or extremely hazardous materials that would be produced,

used, stored, transported, or disposed of as a result of a proposed action. A list of hazardous materials can be found in the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of the SARA of 1986. Extremely hazardous materials are those identified in the EPA's List of Extremely Hazardous Substances (40 CFR 355).

The EPA has developed the Enviromapper, which is a tool that utilizes interactive maps to map, display, and query National Priorities List (NPL) sites. The NPL is a database of the sites containing the most threatening releases of contaminants, hazardous substances, or pollutants in the United States. According to the EPA's Enviromapper, there are no NPL sites within the BCII PA. No hazardous or extremely hazardous materials would be used in the construction or drilling of the wells at the BCII PA and no RCRA hazardous wastes would be generated by the operation of the wells.

3.16 NOISE

The BCII PA is located in a rural setting, which is sparsely populated. The only noise created above normal background levels is from nearby drilling, a compressor station, and localized vehicular traffic. Roads in the area can also cause sound disturbances within the BCII PA.